

# 21.C

THE MAGAZINE OF THE 21ST CENTURY

11/4 D.  
\$9.95

## The Neuromancer

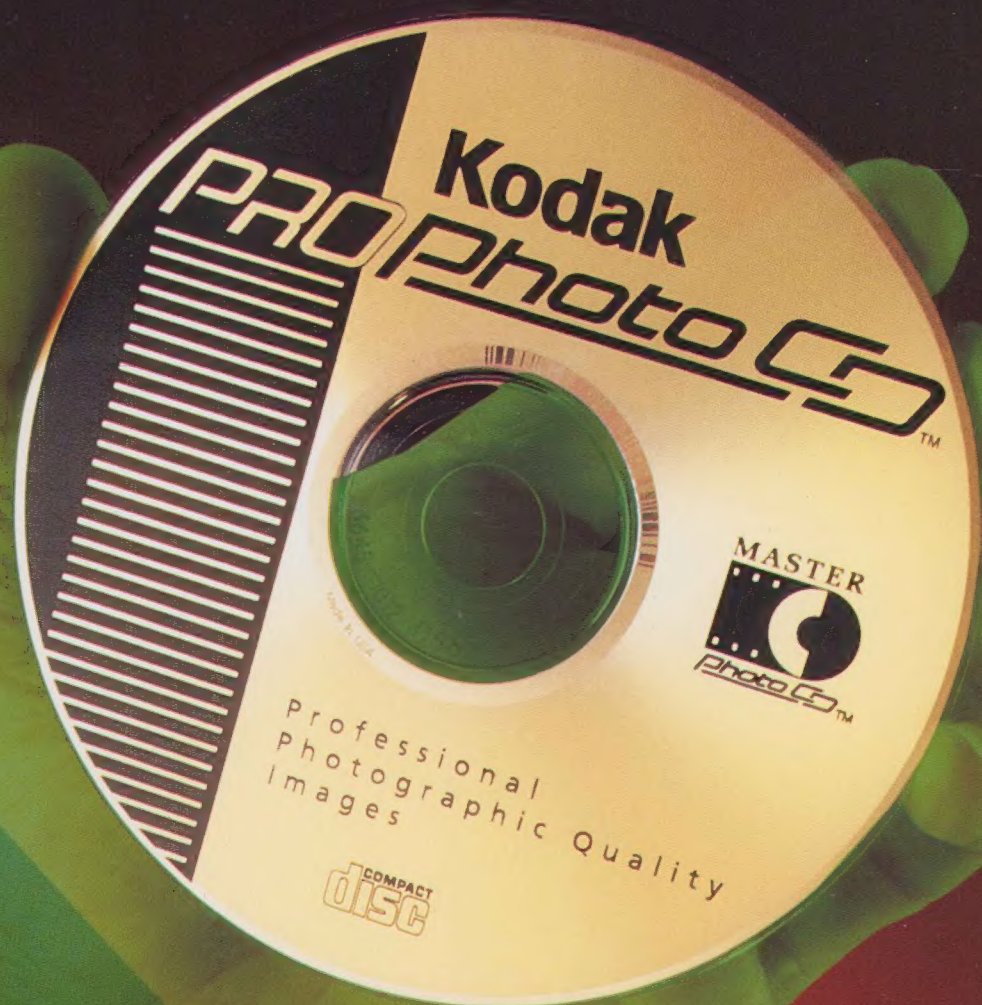
The Cyber Futures of William Gibson by Phillip Adams

ALIENS IN OUR MIDST: From Neptune's depths to Jupiter's moons. DARK MATTER: Paul Davies witnesses the end of the universe. SURFING THE INTERNET: Al Gore, Bruce Sterling and McKenzie Wark waxing electronic. SATELLITE SCAVENGERS: U2 by William Gibson. JUNGLE FEVER: Viral plagues from the forest.

ETHNIC CLEANSING • GRAVITY WAVES • GAY GENES • WILLIAM BURROUGHS • DAVID LANGE

\$9.95 Vol.2 No.1 Spring 1994

**This little disc is going to change your life.**



## ProLink - bridging creativity and technology

What audio CD has done for music reproduction, Kodak's Pro Photo CD is about to do for Australian photographers.

Imagine a technology so convenient, your negatives or transparencies - up to 4 x 5 format - can be transferred directly to Pro Photo CD disc at any participating lab.

Imagine a technology that offers resolution so high, your images can be transferred back to film with no perceptible loss of quality.

Imagine a technology so mature, other film manufacturers have embraced Kodak's standard.

Now imagine what that means to you as professional...

If you're a *commercial photographer*, Pro Photo CD means you can deliver scanned shots, ready to go straight in to most current page layout programs - at a resolution that's high enough for the most demanding print professionals.

If you're finding *photo archiving*, *image distribution* or *folio presentation* is consuming excessive amounts of your time, Pro Photo CD will change the way you work.

And if you're seeking the ultimate in creativity, Pro Photo CD will give you an easy path to electronic *photo editing* of every individual pixel that makes up the scanned shot.

There have been many breakthroughs in the art and science of photography. Few offer Kodak Pro Photo CD's astonishing range of practical and creative opportunities.



### Pro Photo CD - how many images per disc?

The first thing many photographers will want to know is - "How many images can be stored on each disc?"

Regardless of whether your preferred format is 35mm, 120 or 4x5, images can be stored at one of two levels of quality - 'high' for presentations and image review and 'ultra-high' for the highest quality typographical needs.

The 'high' quality can be accessed at five resolutions, from thumbnail up to an image size of 2000 x 3000 pixels. The 'ultra-high' quality has an additional resolution of 4000 x 6000 pixels.

The number of stored images then is not dependent on the format, rather it is dependent on the resolution required. At 'ultra-high' resolution, Pro Photo CD can store 25 images. At 'high' resolution, Pro Photo CD can store 100 images.

Once an image is on disc, the possibilities become endless. Shots can be archived, transferred to a graphics workstation for manipulation - or transferred back to film as a negative, transparency, thermal print or conventional print.

As you can imagine, not everyone is equipped with the means to master Pro Photo CD discs. That's why, as you explore this new world of possibilities, you'll also discover a professional standard that links creativity and technology - ProLink!



## The ProLink network - your link to the future

All over Australia, imaging specialists have recognised the power of a great idea. Whenever you see the ProLink logo displayed, you'll find the assistance, advice and technology that can steer you toward a bold, new future.

Discuss your next project with a representative from one of the organisations listed below, or alternatively, contact Kodak directly on 008 335 000 (353 2177 in Melbourne).

### Australian ProLink Members

#### VICTORIA

##### Allardice Graphic Arts,

10 Apollo Court,  
Blackburn, (03) 878 3000

##### Bond Colour,

4 Gwynne Street,  
Richmond, (03) 429 1299

##### Calthorpe Graphics Pty. Ltd.,

12 Maroondah Highway,  
Ringwood, (03) 870 4077

##### Colour Factory,

21 - 31 Goodwood Street,  
Richmond, (03) 426 1333

##### Corporate Images,

Unit 6, 8-12 Sandilands Street,  
South Melbourne, (03) 696 5777

##### Latrobe Colourlab,

89 Tope Street,  
South Melbourne, (03) 699 2444

##### Network Colour,

180 Bay Street,  
Port Melbourne, (03) 645 4444

#### NEW SOUTH WALES

##### Australian Colour Laboratories,

2/ 39 Hotham Parade,  
Artarmon, (02) 438 3322

##### Colour Developments,

67 Fitzroy Street,  
Surry Hills, (02) 361 5577

##### David Myers & Associates,

91 Willoughby Road,  
Crows Nest, (02) 436 3359

##### Flash Graphics,

84 - 94 Mullens Street,  
Balmain, (02) 555 7011

#### The Lab,

33 Nickson Street,  
Surry Hills, (02) 319 6335

##### Vision Graphics,

88 Pitt Street,  
Redfern, (02) 319 3300

#### QUEENSLAND

##### Digital Imaging Pty. Ltd.,

26 Brookes Street,  
Bowen Hills, (07) 252 2134

##### Profoto Colour Laboratories,

19 Dominion Road, Ashmore,  
Gold Coast, (075) 394 711

##### Prolab,

88 Ernest Street,  
South Brisbane, (07) 844 9621

#### SOUTH AUSTRALIA

##### Computer Slide Centre,

Unit 1, 259 Glen Osmond Road,  
Frewville, (08) 379 5499

##### Duckpond,

16 Fullarton Road,  
Norwood, (08) 362 1521

##### Litho Platemakers,

262 Marion Road,  
Netley, (08) 371 1944

#### AUSTRALIAN CAPITAL TERRITORY

##### Bica Pro Lab,

27 Yallourn Street,  
Fyshwick, (06) 280 7787

#### WESTERN AUSTRALIA

##### Irvin Datacolor,

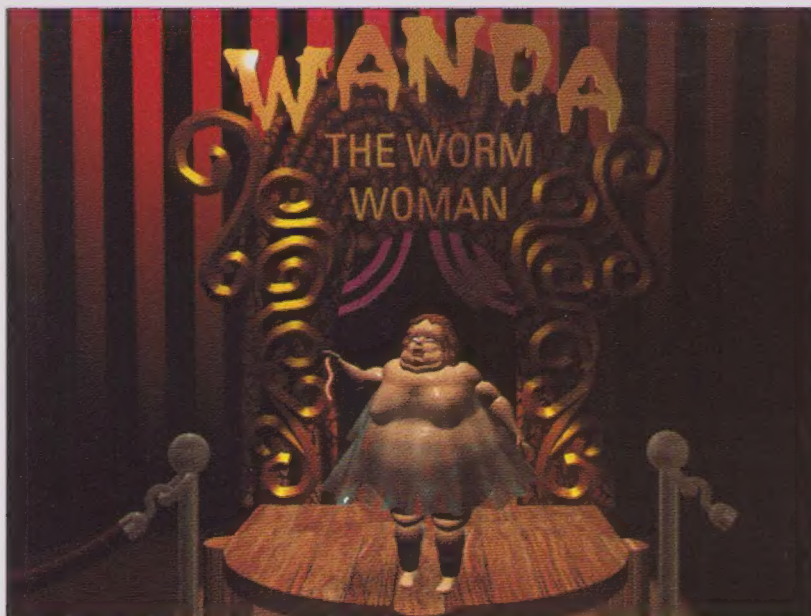
18 Southport Street,  
Leederville, (09) 381 6033



# VOYAGER



NEW YORK PARIS TOKYO



## VOYAGER CD-ROMs AVAILABLE AT

NSW: STATUSGRAPH (02) 552-1388

DYMOCKS DISCOVERY AND LEARNING

(02) 224-0488

VIC: STREETWISE SOFTWARE (03) 819-2891

IC TECHNOLOGIES (03) 457-7000

QLD: IC TECHNOLOGIES (07) 344-4477

ACT: LOGICAL SOLUTIONS (06) 247-1797

## A HARD DAY'S NIGHT



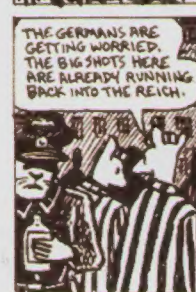
V O Y A G E R



A COUPLE WEEKS MORE AND THEY WOULDN'T HANG...  
IT WAS VERY NEAR TO THE END, THERE IN AUSCHWITZ.



IF WE CAN JUST STAY ALIVE A LITTLE BIT LONGER, THE RUSSIANS WILL BE HERE.



FIRMWARE DESIGN PTY LTD

28 COOMBES DRIVE

PENRITH NSW 2750

PHONE: (047) 21-7211

FAX: (047) 21-7215

# STREAMWATCH

## Care for local waterways

For many city dwellers, the local waterway and adjacent parklands provide the only opportunity for regular contact with a natural environment. Therefore, community expectations should be as important in guiding management practice as academic principles of environmental management. Community perceptions of waterways need to be monitored as well as environmental conditions.

### Streamwatch

The Streamwatch program is conducted by Melbourne Parks and Waterways to monitor the condition and health of Melbourne's waterways. The Streamwatch program involves the sampling of water quality at over 50 sites throughout greater Melbourne. An important part of Streamwatch is the development of indicators of environmental health that can be understood by the general public in the way that employment levels, share prices and wage and inflation rates are understood as indicators of economic well-being. Those indicators can then be used to diagnose and report environmental problems or threats. They can also be used to assess whether community expecta-

tions are being met.

In a survey of community perceptions and expectations of waterways and surrounding recreational areas, five areas of concern were identified:

1. unhealthy, polluted water;
2. lack of public toilets;
3. lack of drinking fountains;
4. lack of rubbish bins; and
5. too much litter.

Clearly, the provision of basic amenities will increase the use and enjoyment of waterways. Improvements in water quality are not so easily achieved.

Although the concept of what is unhealthy or polluted water may be partly based on subjective judgement, it is the main concern for the community. Monitoring of contaminants such as pathogens, nutrients, toxicants and suspended solids is an important part of the Streamwatch program.

In Melbourne, we have seen significant improvements in urban streamwater quality during the past two decades as a result of stricter controls on point source pollution and accelerated sewerage of catchments. Nevertheless, many of

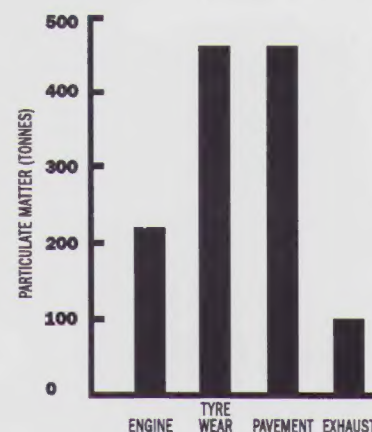
our urban waterways continue to exceed statutory limits for contaminant concentrations.

### Rainwater and pollution

Much of the pollution that enters streams is carried by stormwater. Rainwater washes over city surfaces and collects chemicals, metal particles, industrial dusts, particles from worn tyres and road surfaces, paint flakes, etc. It drains into stormwater drains and then into the nearest waterway. Rainwater also carries with it soil particles from exposed land.

This diffuse source pollution is very difficult to combat. All of us are contributors to it in our own ways. Therefore, the protection of our urban waterways depends on cooperative efforts from all sectors of the community: municipal

councils, business, schools, environmental groups and the general public.



*In the Melbourne area, vehicles contribute around 1250 tonnes of dust particles to the contaminant loads of waterways each year.*

**MONITORING AND TESTING THE WATERWAYS**



## SCHOOL CHILDREN INVOLVED IN COMMUNITY STREAMWATCH



### Rainwater and pollution

Much of the pollution that enters streams is carried by stormwater. Rainwater washes over city surfaces and collects chemicals, metal particles, industrial dusts, particles from worn tyres and road surfaces, paint flakes, etc. It drains into stormwater drains and then into the nearest waterway. Rainwater also carries with it soil particles from exposed land.

This diffuse source pollution is very difficult to combat. All of us are contributors to it in our own ways. Therefore, the protection of our urban waterways depends on

cooperative efforts from all sectors of the community: municipal councils, business, schools, environmental groups and the general public.

### Community Streamwatch

Through the Community Streamwatch program, Melbourne Parks and Waterways encourages and assists schools and community groups to become actively involved in water quality monitoring. Our aim is to increase local concern for waterways and improve understanding of issues relating to the management of those waterways.

With community involvement and

support, understanding of more complex concepts relating to diffuse urban pollution will be easier to achieve.

Most Melbourne residents were outraged when, in 1993, a sewer collapsed releasing hundreds of megalitres of untreated sewage into the Maribymong River. Although a scientific investigation found only short term impacts on the River environment and no harm was done to fish, the sewage spill was seen as a disaster by the public. However, chronic contamination of waterways by urban stormwater drainage continues without a single placard raised in protest.

COMMUNITY INVOLVEMENT THE KEY TO URBAN WATERWAYS PROTECTION



DIFFUSE POLLUTION IN THE FORM OF SHOPPING TROLLEYS



MELBOURNE  
Parks & Waterways

## Departments

Pleasure Dome 10

**The Good, The Mad and The Yuppie.** Hi-tech toys and ground breaking gadgets. David Eyre surveys the fetish of the future shopfront.

Beyond 13

**Wetware:** computers go amphibious; **Violets are red, roses are blue:** genetic engineering and the art of flower making; **James Gleick:** interview with the author of *Chaos* and *Genius*; **In-flight info:** transmitting news without accident; **IMAX call home:** filming the search for aliens in space; **Molten money:** mining the seafloor for the mother lode.

Off the Dish 24

**Motion Capture:** computers replace actors in the films of the future.

Whirled Art 26

**Press Enter for Art**  
For software magnate Bill Gates, art is more than just colour on canvas; it is information fodder for the ravenous digital memory of the future. Corey S. Powell takes a stroll through the gates of a future art gallery.

War and Peace 94

**Peacekeepers Wake**  
The United Nations has been accused of impotence over Bosnia and Somalia. Former Prime Minister of New Zealand David Lange describes the organisation as incompetent and unwieldy.

Looking Glass 98

**Grass Skirts and Burning Bras**  
When the prime minister considers beating up your wife a form of relaxation, feminism faces a hard battle. Michael Perry reports that equal rights may yet overcome in the South Pacific.

Scan 98

**Minsky's Brain:** The father of AI on CD-ROM. **Eight Little Piggies:** Stephen Jay Gould's latest evolutionary epic.

Visions 106

**Stupider and Stupider**  
William S. Burroughs looks into the future, and he's not impressed with what he sees.

# contents

30

**Unmasking the Dark Avenger**

A crazed technopath is hacking into the nets of the world, and there are a million disasters going down in the Naked Network. Nico Krohn turns bounty hunter for 21•C.

34

**Surfing the Internet**

Hanging five on the waves of cyber-consciousness, 21•C drops in on Bruce Sterling, the Media Lab's Amy Bruckman and US Intelligence Officer Robert David Steele on the way. McKenzie Wark and Rosie Cross provide the surf report.

39

**Outlaws on the Net**

The Internet isn't the utopian infoscape it used to be. With corporations out for easy money and libel cases flying, Paul Wallich reports from cyberia's gulag.

40

**Do Vice-Presidents Dream of Electric Sheep?**

The US is kicking into turbo drive on the infobahn. Al Gore details his vision for how the information superhighway will revolutionise the 21st century.

44

**The Hitchhiker's Guide to the Infobahn**

While governments intervene on the mapping of the Internet, Geoff Chester from Washington's Centre for Media Education and David Lytel, of the White House Office of Technology ask whether the poor will end up as road kill on the infobahn. Phillip Adams plays traffic cop.

48

**Accidental Guru**

Some people are born into greatness others are thrust into cyberspace. Phillip Adams meets the godfather of cyberpunk, William Gibson.

52

**Satellite Scavengers**

The airwaves once dominated rock'n'roll, but as U2's Zoo TV proves, the new media ranges from satellite control to an e-mail fan club. William Gibson plays ringmaster.

58

**Invasion of the Body Viruses**

The world could be on the verge of an outbreak of horrific diseases far worse than HIV. As humans infiltrate virgin rainforests, unknown viruses are being unleashed. Steve Mirsky reports.

62

**Designer Drugs**

The body hosts a cocktail of viruses, partying in a hierarchy of their own. With supercomputers, scientists can gatecrash their world at the molecular level. Mark Kestigian scores an invite.

66

**Romancing the Stone Age**

The inspiration for *Jurassic Park* is currently unlocking the secrets of Austria's 5000 year old Ice Man. Maria Russell meets the maestro of molecular anthropology, Thomas Loy.

70

**The Complaint of Culture**

Every day, images of conflict cascade down the satellite feeds into the living rooms of the world. Is the explosion of racial and ethnic violence of the 1990s just the backwash of the decay of the old East-West hegemony and the proliferation of weapons? Or – perhaps more ominously – is this the rise of a new social ill? Wilson da Silva reports.

76

**Keep Your Hands Off Our Genes**

Research into the genetic cause of homosexuality may have a chilling outcome: the genetic manipulation of human behaviour. Darryl Ribaux investigates the fallout from the possible discovery of the 'gay' gene.

80

**The Drama of Dark Matter**

The fate of the universe may hang on Machos, Wimps and a theory discarded by Einstein. Paul Davies considers a future engulfed in dark matter.

84

**Rattling the Cosmic Cage**

Gravity waves ripple undetected through the universe. Capturing them may be the greatest challenge known to physics. David Blair tests their measure.

90

**Aliens in the Abyss**

The discovery of new life forms on the edge of volcanoes at the bottom of the sea could revolutionise our understanding of life, not just on Earth, but on the moons of Jupiter. Tim Thwaites enters the lair of the white worm.



Cover: William Gibson by Anton Corbijn

21•C Spring Vol.2 No.1

#### Publisher

Ashley Crawford

#### Managing Editor

Wilson da Silva

#### Editors

Ray Edgar

Ashley Crawford

#### Contributing Editors

New York: Laurie Shapiro;

Sarah Bayliss,

Sydney: McKenzie Wark

Tokyo: Yukiko Shikata

#### Design

Fabio Ongarato Design:

Tim Richardson

Ronen Goren

Fabio Ongarato

#### Production

Terence Hogan

#### Copy Editor

Stephanie Holt

#### Editorial Support

Melissa Conrad; Arwen Crawford

#### Publicity

Michelle Buxton

Tel. (03) 534 0857

#### Published by

Gordon and Breach Science Publishers

#### Advertising (Australasia)

David Fallick, Indigo Arch Pty Ltd

PO Box 114 Malvern, Victoria 3144

Tel. (03) 576 1275

Fax. (03) 576 1276

#### Advertising (North America)

Laurie Shapiro

Tel. (201) 643 7500

Fax. (201) 643 7676

#### Advertising Support

Francesca Valmorbida

#### Printing

Jenkin Buxton

#### Pre-press

Litho Platemakers Pty Ltd, Adelaide

#### Distribution

Newsagents Direct Distribution

Pty Ltd (NDD)

Tel. (02) 693 4141

Fax. (02) 669 2305

21•C is the quarterly publication of The Australian Commission for the Future Ltd. All editorial enquiries should be directed to The Editor, 21•C magazine, PO Box 95, Prahran, Victoria 3181. Tel. (03) 827 2121; fax. (03) 827 5281. 21•C cannot accept responsibility for unsolicited manuscripts, transparencies, illustrations or other material. Subscription enquiries within Australia should be directed to Rhonda Fitzsimmons: Tel. 008 224 018; Fax. 02 417 1045. PO Box 480 Roseville, NSW 2069, Australia. 21•C is published in association with the Australian Broadcasting Commission, ABC Enterprises, GPO Box 9994, Sydney, NSW, 2001.

© The Australian Commission for the Future (1994). All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means electronically, mechanically, photocopying, recording or otherwise, without the prior written permission of The Australian Commission for the Future Ltd.

#### Contributors

**Phillip Adams** is host of *Late Night Live* on ABC's Radio National and a columnist for *The Australian* newspaper. **David Blair** is associate professor of physics at the University of Western Australia in Perth and a leading researcher in gravity waves. **Rosie Cross** is a Sydney-based writer and producer at Radio National. **Wilson da Silva** is an editor of 21•C and a former Reuters correspondent. **Paul Davies** is professor of natural philosophy at the University of Adelaide, and bestselling author of 20 books in science, the latest being *The Mind of God*. **William Gibson** is a Vancouver-based science fiction author and winner of the Nebula Award for his *Neuromancer* series. His most recent book is *Virtual Light*. **Al Gore** is Vice-President of the United States and author of the best-selling environmental book, *Earth in the Balance*. **David Lange** is the Wellington-based Labour opposition spokesman on foreign affairs and was Prime Minister of New Zealand from 1984-89. **Nico Krohn** is an American journalist in Prague who writes for *The Wall Street Journal* and is a correspondent for the BBC. **Mark Kestigian** is a former correspondent for *The New York Times* and now marketing manager for Melbourne's Strategic Industry Research Foundation. **Steven D. Mirsky** is a New York-based science writer and a regular contributor to *Newsday* newspaper and *American Health* and *Earth* magazines. **Michael Perry** is a Reuters correspondent and president of the Foreign Correspondents' Association in Australia. **Corey S. Powell** is the New York-based

science and arts editor for *Scientific American*. **Darryl Ribaux** is a Melbourne-based writer and a regular contributor to 21•C. **Maria Russell** is a Melbourne-based science journalist. **Tim Thwaites** is a correspondent for *New Scientist* in Melbourne and a former ABC journalist. **Paul Wallich** is an editor of *Scientific American* and a New York-based veteran of the Internet. **McKenzie Wark** is a lecturer in cultural studies at Sydney's Macquarie University, a columnist to *The Australian* newspaper and author of *Logic Bombs: Living with Global Media Events*. **Nicholas Zurbrugg** is a senior lecturer in literary studies at Griffith University in Brisbane, and author of *The Parameters of Post-Modernism*.

twenty first century

# editorial

Welcome to the new-look 21•C. This is Issue 1, Volume 2 of the magazine founded by the Australian Commission for the Future Ltd. While it represents a progression in style and format, it also marks a return to the principles so successfully established in the first few years of the magazine: to describe the grand narrative of the future in an engaging, visually dramatic way; to dissect emerging trends and discuss them; and to lead the debate by bringing together the views of the best and brightest.

In this issue, we turn the microscope onto emerging viruses, new and bizarre strains of horrific diseases which are now emerging from the once secluded rainforests of the world and into the major urban centres – viruses which make HIV look tame. Best-selling science author and leading scientist Paul Davies, of the University of Adelaide, explains how the fate of the universe hangs on the mysterious substance known only as 'dark matter'. We look at recently discovered life-forms living near volcanic vents on the sea floor, life-forms so bizarre that some scientists say they could live on the sulphuric moons of Jupiter. Ambitious plans to detect the elusive intergalactic eddies known as gravity waves are detailed by one of the world's leading authorities in the field, David Blair of the University of Western Australia. And we profile Thomas Loy, the man whose tinkering with test tubes and ancient stone tools in a Canberra laboratory sparked a new field of research and became the inspiration for the blockbuster film, *Jurassic Park*.

The future is also about society and culture. We look at the worrying trend of cultural fragmentation now gripping the world from Bosnia to Kurdistan to Los Angeles; while former New Zealand Prime Minister David Lange describes how the star of the United Nations, which seemed to shine so bright at the end of the Cold War, is falling as ingloriously as the Berlin Wall.

By far the most dramatic development we cover is the cyberisation of today's world. The Internet is worming its way into our consciousness and our everyday lives; but exactly what is this communications revolution and what will it do to the world? 21•C plunges into the world of the 'net; U.S. Vice-President Al Gore outlines his vision for the potential of the Information Superhighway, while leading 'net identities Bruce Sterling and Geoff Chester, among others, point to the many potholes already visible on the 'infobahn'. Veteran 'net surfer and long time 21•C contributor, McKenzie Wark, joins Rosie Cross on a cruise down the infobahn, picking up hitchhikers such as the MIT Media Lab's Amy Bruckman and U.S. Intelligence

Officer Robert David Steele on the way. Just to confirm that the 'net is not quite the utopian infoscape envisaged, Paul Wallich details how some lawyers are already scanning the Internet for easy money, and cyber-libel cases are already piling up; meanwhile Corey S. Powell tells us how software magnate Bill Gates is sucking the arts into a brave new digital world. Nico Krohn unmasks Dark Avenger, the shady computer hacker whose lethal computer viruses send shivers up the spines of computer network managers around the world; and science fiction author William Gibson, considered the patron saint of every cyberpunk, profiles satellite scavengers U2, the supergroup fashioning a hi-tech, multimedia future for rock 'n roll.

And, in the Visions section, William S. Burroughs details his rather gloomy forecast for humanity's future.

All this is here, in an issue which sees the return of a previous editorial team to the helm: editors Ashley Crawford and Ray Edgar, now publisher and editor respectively; and regular contributor Wilson da Silva, who metamorphoses into managing editor. It also sees the sealing of a formal agreement between the Commission with the global Gordon + Breach Publishing Group to publish this successful magazine title, and the promise of an international presence for 21•C in the near future.


We hope you will enjoy this trip into the promise of the future, and choose to join us in travels ahead. The next millennium is now six years away, and we have a lot of ground to cover.

**Ashley Crawford, Wilson da Silva, Ray Edgar.**

## The Commission's new future

These are exciting times for the Australian Commission for the Future. Despite media speculation as to the Commission's well-being, dramatic changes to the Commission's structure and objectives assure its role in the future of Australia.

In an alliance with Monash University, a new director will be appointed shortly to take the refined Commission on a new course. Its role will focus on the impact of technology and science on our future and the key issue of how Australia will develop in the Asia-Pacific region. Research will be conducted, to define well considered pathways into the region, utilising the wealth of intellect and research in this country.

Finally, the Commission will retain a close relationship with 21•C as it prepares to launch into the international publishing arena. 

**The Australian Commission for the Future Ltd**

# The Good, the Mad and the Yuppie



The Kodak DCS200 electronic camera

by David Eyre

As the new millennium approaches, all that science fiction promised is manifesting itself in an explosion of gadgets, from the absolutely essential to the plain tacky.

Need a clock that counts down your life from the statistical average of 2.4 billion seconds? A digital canary that sings and flaps its wings when you come near? A phone that undetectably disguises your voice so that you can sound like a man, a woman, or your own secretary? Of course you do.

Technology may not have rid the world of famine, disease and poverty, but it certainly can supply a wealth of gadgets. Gadgets are becoming increasingly ubiquitous, exceedingly clever, exponentially powerful and, let's face it, essentially designed for hyperconsumption. But gadgets are also selling us more gadgets.

Take the Sharper Image store, supplier of the clock, canary and phone. Sharper Image is a superb example of that global phenomenon, the franchised concept store (McDonalds, The Body Shop, etc). It's all about shopping as entertainment; the store as product.

The 90 or so Sharper Image stores cloned worldwide are a cross between a games arcade and a high-priced duty-free shop. The aim is to sell a "unique assortment of original gifts and exciting products". You are encouraged, by the store layout, and by the articulate, gadget-crazed staff, to joke around and have fun. Brilliant retailing. But watch that credit card.

The tape recording briefcase is a must for that next business meeting. "Excuse yourself from negotiations to go to the restroom while the case secretly records the other side's deliberations," the blurb declares. Of course, you shouldn't forget your pocket-sized bug detector to alert you if the Other Side has also brought a recording briefcase. In fact, don't attend the meeting at all, just send your briefcases.

Worried about thugs? Buy SoundMate, a handheld, squeeze-activated, personal alarm

that belts out a bone-jarring 120 decibels – that's jackhammer level. Oh, it's also bullet-proof and can only be disabled by a user code. Its swirling, phase-shifted siren creates the illusion that you are at the convergence point of several speeding police cars. Don't squeeze it for fun unless under the age of 16. And don't forget that code.

Sometimes it is harder to draw the line between the seductive gadget and the genuinely useful tool. I have a weakness for small, powerful computers and fantasise about a laptop unchaining me from my desk. The Apple PowerBook 540c, weighing in at 3.3 kg, has a fine colour screen, is as fast as a Quadra and is upgradable to Power PC. Its Apple Track Pad allows precise cursor movement by finger on the small, built-in pad. This latest offering from Apple is fast enough to serve as primary workstation for designers and other users of power-intensive applications.

Many a designer has ended up a road-kill as digital technology hurtled through publishing's backwoods. Now suppliers and users of conventional photographic are in the headlights. Eschewing the role of mesmerised rabbit, Kodak is at the wheel of a load of new hybrid and fully digital products.

Electronic cameras are a long way from matching the image quality given by silver halide emulsions, but for those willing to trade image quality for speed of turn-around and convenience, they are increasingly attractive. The Kodak DCS200 is already used in Australia for industrial and scientific documentation, junk mail catalogues etc. The daily print media and domestic snap-shot markets are the next most promising targets.

In this regard, two other new products are



1. The Image Magic Digital Print Station



2. The Apple 540c PowerBook



3. The Apple Quicktake 100



4. The Kodak Portable Photo CD player



5. The Personal Life Clock

significant: the NewsCamera 2000 and the Apple Quicktake, both using Kodak image-coupling technology. Just released in the U.S., and available in Australia from Graphax at around \$30,000, NewsCamera 2000 is a collaboration between the U.S. media giant, The Associated Press news service, and Kodak.

The unit is built around a Nikon N90 body with standard controls and lenses, and takes instant, print-quality digital images at two frames per second in bursts of up to six exposures. Its miniature removable storage disks hold 75 images while a built-in microphone records spoken shot notes, indexed to frame. Using Photolynx, a Macintosh-based portable photo scanner/transmitter, it can deliver images from the field by cellular phone.

At the other end of the market is the Apple Quicktake. Quicktake is both widely affordable and smoothly interfaced with powerful software. The camera takes 32 standard resolution, or 8 higher resolution images. Producing low-resolution, video-standard images, these cameras may find a niche in low-cost commercial, as well as amateur, media production.

Yet to be unveiled, the Kodak Image Magic Digital Print Station is an easy-to-use, low-cost, retail imaging platform that allows customers to manipulate conventional or digital images using a touch screen. Scan your image (an old print; negative or positive film; a photo CD), manipulate it on-screen, get a print out – brilliant. Kodak reasonably expect Image Magic to reinvigorate the photo market when it is introduced in stores later this year – market trials have shown a four to eight-fold increase in enlargement business. And just a little further down the track, you'll be able to combine text with your image – watch out

greeting card industry.

Another hybrid product, combining powerful digital processing with the high resolution of emulsion film image sources, is the Kodak Portable Photo CD Player 960. This notebook-sized unit, coupled with Kodak's Portfolio CD authoring software, seems likely to cause further escalation in the interactive multimedia presentation arms race. Doubling as an audio CD player, the unit will allow users to plug into any TV monitor or video projection system to deliver fully programmable presentations from a basic CD source. Frames can be skipped, rotated, panned across and so on.


My favourite, most necessary, gadget is my modem – more precisely the Internet it gives me access to. For those not connected to the net via an institution, direct access may be gained through Connect.com. This clever company will put you or your organisation right on the virtual map as an independent electronic mail address: ie. me @my place. com.au – 'com' stands for commercial, 'au' for Australia. Alternatively, you may prefer the packaged services and information filtering provided by an organisation like Compuserve Pacific, or more basic services provided by Pegasus Networks in Brisbane or Apana in Melbourne. The downside of these latter services is that you have no direct net access, restricting you from exploring the depths of cyberspace. Connect.com costs \$5,000 per year for a dedicated line – 8,760 hours of cyber surfing. With Compuserve you pay \$15 a month, connect charges by the minute and extra for various special services.

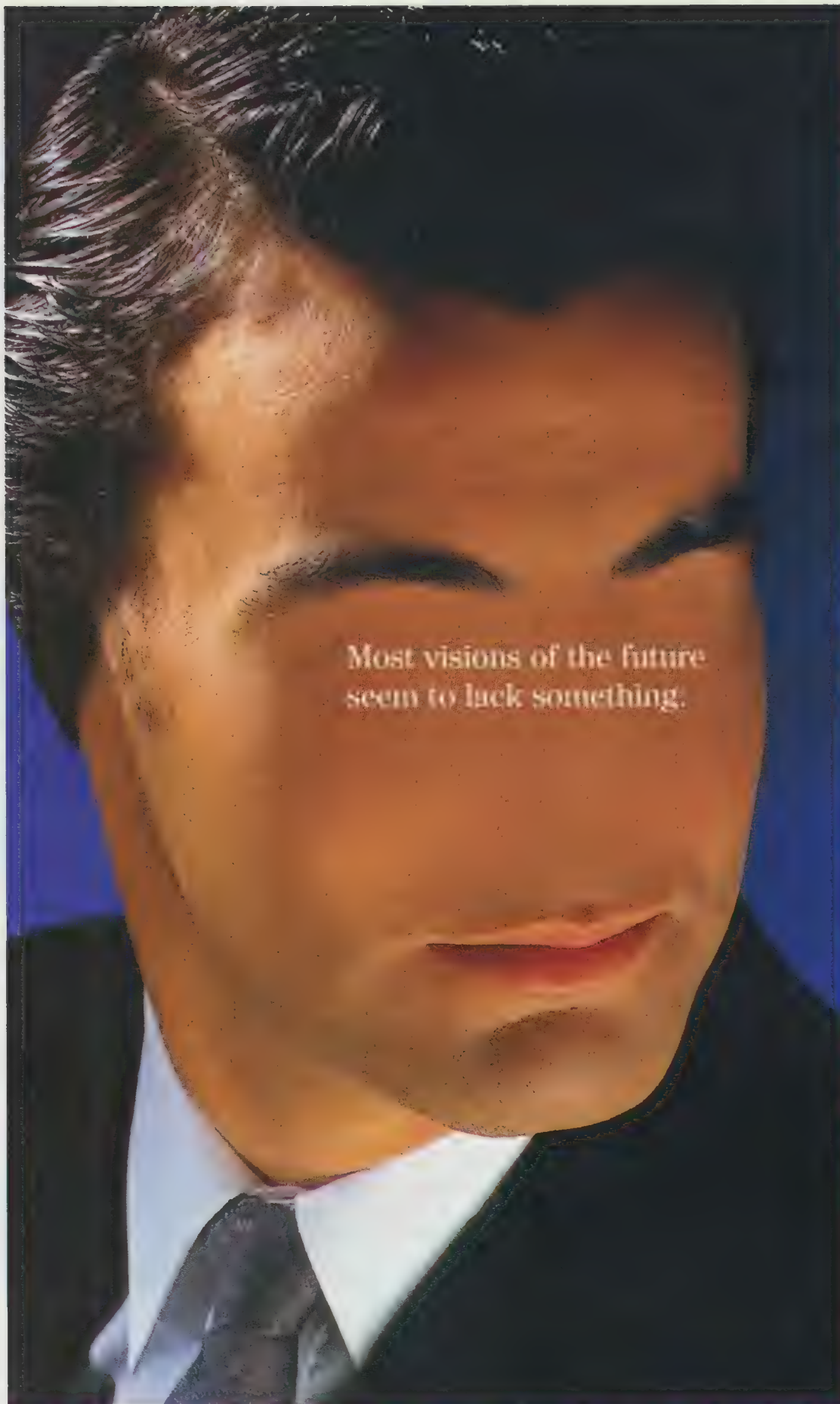
Finally, a word on hi-tech accessories: do you really need that electronic organiser/memo taker or have you been seduced? Myself, I can't

yet see the appeal. The tiny keyboards deter me for one thing. But the market for memory aids and related gizmos is strong, and this is driving rapid innovation. A classic transitional product is the digital Pencorder 20: "The pen that speaks for itself". Can we expect to see executives talking to the tops of their pens, à la The Man from UNCLE?

Another miniature recording gadget made possible by the descending prices and increasing sophistication of microchip technology is the Voice It card. This credit card-sized device will record six to eight messages or a list of about 40 items. The really interesting thing about these devices is the potential of their technology. Imagine the utility of a miniature device capable of recording/organising/recalling data entered by voice. Speaking units such as the much-awarded Psion RL400 are already in the stores and more breakthroughs are sure to follow.

In my view, however, truly useful miniature PA devices cannot be expected in the immediate future – but you can see the various strands rapidly converging; the Apple Newton; the Psion RL400; the extraordinary Casio remote watch, which allows you to seize control of other people's VCRs, stereos, and TVs while you visit their homes. Relatively soon we will be able to purchase watch-sized organisers with voice data input/output and basic relational data bases. These will be nearly impossible to resist.

But even these gadgets will be hurled away as we line up for Dick Tracy style wrist communicators: on these, any time, any place, we will be able to call Big Brother, or line into HAL and they will tell us everything we need to know. And if we forget to call them, they'll call us. 



Most visions of the future  
seem to lack something.

JWT HDH 010

When people imagine some future technological time, they only ever seem to think of computers. Oh, and maybe communications. And that's it.



At HP, we don't believe that's enough. Because it's like imagining a human being with just a brain and a voice. And nothing else. How would they know what was going on in the outside world? Hear what it was you wanted? See what needed doing?



There's a piece missing here. Measurement. Measurement is what allows man and machine to interact fully. It's how machines extend man's senses. And Hewlett-Packard know more about measurement than any other company in the world.



Mind you, it's not the only thing we know. Which is why our vision of the future mixes equal parts of expertise in Measurement, Communications and Computing. Or  $MC^2$ , as we call it. And while we won't guess exactly what the future holds, we will bet it equals  $MC^2$ .



**HEWLETT®  
PACKARD**

A Better Way.

# Wetware

Amphibious computers



by Brett Wright

**After developing the world's first strap-on-and-swim underwater computer, its Australian inventors are now claiming to have devised a fundamentally new way of operating personal computers in difficult environments.**

The Australian Institute of Marine Science (AIMS) – which recently developed ‘wetPC’, the first computer intended for use while swimming – says the new mode of operation may become the field equivalent of the computer mouse and keyboard.

The new “mobile user interface” and its associated hardware is essentially a novel method for entering data and commands into a computer, and the representation of commands

on a monitor. No keyboard or pointing device such as a mouse is needed, and only large strokes with the fingers of one hand are required in order to select commands.

The interface employs a “chordboard” or “chordic keyboard” comprising five or seven buttons which are pressed in different combinations. But unlike all previous known applications of chordboards, each ‘chord’ does not correspond to a fixed instruction such as ‘Save’ or ‘Delete’, but can represent many instructions depending on the context of the operation. The user is guided by ‘virtual buttons’ which appear on the monitor in positions which closely relate to the relative positions of the digits on either the left or right hand.

AIMS, which is based at Townsville in far north Queensland, has recently applied for patent protection for the invention.

The institute believes the new human-computer interface has wide applications in environments too noisy or unstable for voice or handwriting recognition technology, or where the user is moving too much to use a pointing device such as a computer mouse or trackball.

Among the applications envisaged are the use of computers by construction and factory workers, soldiers in combat, joggers, divers, climbers, researchers in the field, and astronauts. The development may also have applications in courtrooms and on busy stock exchange floors where computers using voice recognition software would be unable to operate.

The inventor, Bruce Macdonald, a marine technologist at AIMS, said the system is easy to learn and efficient to operate.

“Unlike the Qwerty keyboard or a mouse, it uses the natural gestures of the hand, and the buttons – which are in the software – can be mapped to anything you like.”

Macdonald says the chief advantage is that the interface only requires “muscle memory” to learn and “gross motor movements” to operate,

which make it ideal for computer work underwater or in a mobile environment where no desktop exists and the user’s hands are being buffeted or hampered by heavy gloves and equipment.


“We think we’ve cracked onto a completely new style of interface with computers, and ultimately it might become as important as the mouse for certain environments. We’re crossing our fingers that Australia has managed to nab a very fundamental human-machine interface,” he said.

The mobile user interface grew out of recent efforts by AIMS to adapt PCs for use by its marine scientists during field surveys on the Great Barrier Reef. The wetPC was developed to lift the data collection capacity of researchers during dives.

The amount of time spent in the water is a major component in the cost of marine research, and long dives pose a risk of nitrogen narcosis for divers.

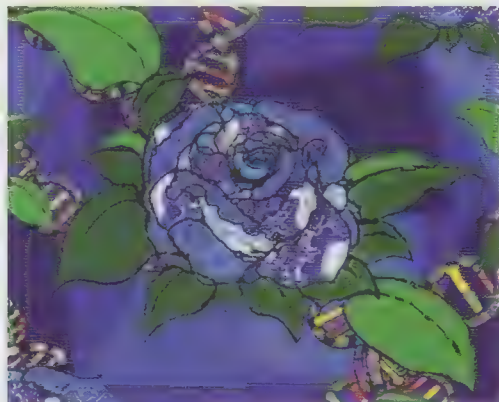
The central processing unit of the computer is housed in a sealed module mounted on the diver’s air tank. As the diver swims downward, air from the tank is fed into the module to stop the unit from being crushed by the increasing water pressure outside. When the divers ascend, air is progressively released from the module.

A chordic keyboard is strapped to the diver’s chest, and a small computer monitor is mounted on the face mask or a small arm connected to a band around the diver’s head.

In trials, the wetPC has been connected to an acoustic navigation system which allows divers to swim in total darkness without losing their bearings. AIMS, which hopes to commercialise the development, believes an underwater computer with navigation system would be invaluable for police and naval searches, and by divers working on oil rigs. AIMS estimates the market for the system on oil rigs alone at about 10,000 units worldwide. 

# Violets are red

Roses are blue



Credit to go here

by Maria Russell

**Genetic engineering has created the perfect symbol for lost love – the blue rose. It is also developing the answer for jeans that will never dye – naturally-grown blue cotton. Economically, the benefits are exceedingly rosy – if not blue chip.**

Since the 15th century the Arabian Nights recounted the tale of a blue rose. In the 19th century, botanists and amateur gardeners began searching more seriously for such a flower, with results that were more mauve than blue. But now Australian scientists are on the verge of creating the truly blue flower. Late last year, Melbourne scientists announced that they had isolated the gene responsible for

making flowers blue, and that one of the first blooms to implanted with the gene would be the rose.

The finding, published in the British science journal *Nature* may turn the fictional blue rose into an industry potentially worth \$1 billion a year. Dr Tim Holton and his colleagues at Calgene Pacific Pty Ltd have isolated and cloned the gene for delphinidin – the blue pigment present in flowers such as petunias and irises, but which is absent in most other blooms such as roses, chrysanthemums and carnations. It is these three flower varieties that make up half of the world's cut flower market, totalling \$25 billion annually.

According to Holton, for a flower to be blue, it must produce the delphinidin pigment as well as co-pigments, called flavenols. The researchers have also isolated and cloned the gene for the production of flavenols.

Two years ago Holton and his team isolated what they believed was the "blue gene" from petunias, as well as the necessary co-pigments. They began by putting these genes into white petunias – the perfect experimental model because they bloom within three months of planting. "The results could be seen relatively quickly and we knew, very soon, whether we were on the right track," Holton said. "Putting the gene and co-pigments into roses or carnations, as a first step, would simply take too long to get initial results."

The scientists put the "blue gene" into regenerating shoots of white petunias. When the plants grew and bloomed three months later the flowers were a deep violet-blue. The researchers also took naturally blue petunias and inactivated the "blue gene", resulting in a plant with white flowers. This test was an added check that the gene they had found was indeed the one responsible for conferring the colour blue. The researchers have also been


switching the gene off in naturally blue flowers such as irises – the resultant blooms are red.

The lucrative side of the research has seen the scientists putting the gene into the more popular flowers such as roses, chrysanthemums and carnations. The world market for cut flowers generates US\$25 billion a year – of which roses account for half. Holton estimates the potential market for blue flowers is up to 20 per cent of this market.

Early studies with carnations have found that inserting the "blue gene" turns the flower only slightly blue. Dr Edwina Cornish, managing director of Calgene Pacific, said the colour is not strong enough for commercial use, "however, we are very encouraged that this colour can be deepened".

Calgene Pacific, in collaboration with the Japanese company, Suntory, has been awarded patents for the genes in Australia and the company is hopeful that patents will be awarded patents in Europe and the United States, giving the company almost worldwide rights to market blue flowers.

But discovery of the "blue gene" has application outside of the florist shop. Fabric dyes used to colour cotton are often hazardous and their wastes are polluting. Calgene Pacific's sister company in northern California, Calgene, is trying to develop genetically engineered blue cotton which is less harmful to the environment than synthetic dyes. The researchers are planning to insert the genes responsible for the production of the blue colour in the indigo plant into the cotton plant, making the harvesting of a crop of blue Levi's a real possibility.

Another company is also hot on the blue gene trail. Agracetus, of the United States, is planning to engineer the genes from the indigo plant so that they are only active in the cotton fibres – the goal is a field of cotton plants with blue bolls. 

# Author



by Brigid Mullane

James Gleick has reached celebrity status thanks to his book 'Chaos', which brought the complexity of non-linear systems to dinner table discussions around the world.

James Gleick makes science famous. His book *Chaos* made researcher Benoit Mandelbrot a household name. Now he has done the same for physicist Richard Feynman, the subject of his last book, *Genius*. Yet Gleick, the former *New York Times* journalist who added chaos theory to the mainstream lexicon, is anything but chaotic – he is an unassuming New Yorker whose ambition is to humanise science.

*Genius* is a biography of the physicist Richard Feynman, a giant of 20th century physics. He worked at the famed high-energy labs at Los Alamos in the U.S., helping to create the atom bomb. He made discoveries in quantum physics, impressing such luminaries as Albert Einstein, and went on to win a Nobel Prize in 1965 for this work. Feynman even helped investigate the *Challenger* space shuttle disaster, exposing the wishful thinking in NASA's approach to risk assessment.

Other than being a New Yorker like Feynman, Gleick appears to have little in common with his subject. In fact, they've never met. Yet Gleick talks easily about the man, his life, and his achievements in physics, as though discussing an old friend.

"Feynman spent a lot of time in his teenage years filling up notebooks with calculations and working out formulas and techniques of calculation. These techniques were really useful to him years later, when he needed to look at difficult problems," Gleick says. These days, he adds, "too many scientists seem to have lost this computational ability – perhaps the calculator is to blame."

One of the difficult problems that Feynman tackled was the formulation of a coherent theory to explain the way energy and matter interacted. He and his two colleagues' successes, won them the Nobel Prize and spawned the field of quantum electrodynamics.

"Quantum electrodynamics is the awkward name given to the theory of what happens when light and matter, or energy and matter, or radi-

ation and matter, interact. Feynman produced a whole new way of looking at these interactions on atomic scales and sub-atomic scales that laid a foundation for all of modern physics. In a sense, everything in physics, and for that matter in chemistry and biology, rests on this theory as its foundation," says Gleick.

However valuable this theory may be, it is certainly harder to grasp than, say, Isaac Newton's explanation for gravity. Gleick agrees. "Physics has gotten so esoteric these days, and so specialised, that it's difficult for us normal folk to get a clear sense of what's involved. Feynman himself thought that no one really understood quantum mechanics."

Perhaps that is why Feynman is best known for an achievement that had little to do with such obscure areas of physics; his much-publicised role in the investigation of the explosion of the *Challenger* space shuttle in 1986.

"Feynman used his faith in the simplicity of nature to cut right through a lot of technical jargon that was being thrown up at the Presidential Commission by a lot of experts, and to demonstrate the physical cause of that disaster, which was almost as simple as noticing that the rubber seal of the rocket lost its resilience when it got cold. Of course, the reality was a little more complicated, and I feel that Feynman's greatest contribution to that presidential investigation wasn't that well-publicised moment when he demonstrated that physical fact.

"It was much later when he began to look at the mathematics of risk assessment and discovered that somehow the engineers on the project had known that the probability of a disaster was something on the order of one in a few hundred. When those mathematics had been processed a little more by the administrators, it came out to something like one in 10 million, but of course one in a few hundred was more like it. Feynman worked out why that was and, in his appendix to the official report, sharply criticised the American space agency for its

bureaucratic ability to overlook the real risks of a tremendously complicated technological enterprise like this."

Gleick reiterates Feynman's advice to aspiring young physicists: "He used to warn graduate students who were thinking about a line of research, that they should stay away from the beaten path and, instead, go off on some seemingly less profitable avenue all by themselves. Then, if they succeeded, they would have done something really original and useful, whereas if they did what everyone else was doing, even if they succeeded, they would just be part of a huge crowd." Gleick admits that such advice is dangerous, but it certainly worked for Feynman.

The beaten path in today's scientific world is probably the one to chaos theory. Gleick is still enthusiastic about the subject he made famous, but acknowledges that it has not developed to the point where it can help solve real problems.

"It offers new ways of looking at a whole range of phenomena," he says. "Sometimes these ways are descriptive and they don't seem to offer an immediate explanation, but for the scientists working in this field, being able to see in a new light, connections between a whole range of chaotic phenomena – erratic and

discontinuous processes in the weather or in the human body or the economy – is enormously helpful."

In a sense, computers created chaos theory. Patterns in chaotic systems became apparent only when computers became sophisticated enough to model such systems. Would more powerful computers help move past chaos and predict behaviour in very complex systems? Gleick does not think so.

"Computers made a contribution to chaos theory in the sense that they could be used interactively, with graphics screens. So, instead of feeding in a problem and expecting an answer, the researcher would set up a whole situation and then tinker with it a little bit – they would turn a dial, so to speak, or they would change the value of a certain number and they would instantly watch how patterns on their screen changed. This gave them a whole new insight into the behaviours of complex systems that they were in effect modelling on the computers. So that's where computers helped, in giving a sort of microscope into this new region of behaviour that had never been able to be explored in this way."

Much of this tinkering led to the creation of

fractals, those fantastic images that are both artistic science and scientific art. Gleick believes that their real value is scientific.

"Their real value for scientists didn't really have anything to do with how pretty they were, of course. It had to do with the insights that they provided into complex systems that couldn't be easily recognised when they were just in the form of a lot of numbers.

"The fractal pictures showed patterns, and fractal patterns have a tendency to be self similar; that is, the more you zoom in on them and look at them at different scales the more you see that they are either exactly the same, or doing something that's sort of the same thing. That's part of their beauty, but for mathematicians and physicists it is, more importantly, part of why they provide insight into the workings of physical systems and into the natural world."

Having investigated the scientific worlds of Feynman and fractals, the ever curious James Gleick is now working on a history of telecommunications. Sort of.

"My next book is not going to be about physics, it's going to be a sort of history of the telephone. So you can tell me if that's a scientific subject." ■

# Economy Class Couch Potato

by Luke Hunt

Melbourne-based ASI Technologies Pty Ltd has claimed a major victory over its international rivals and says it will become the first to develop computer hardware that will enable direct satellite transmission of television news and other information into international air carriers.

The hardware overcomes one of the last and biggest stumbling blocks facing airlines around the world by allowing passengers access to real-time news, information and personal messages that can be beamed directly to any aircraft from anywhere on the planet at any time.

"In layman's language, it's like inventing the mobile telephone," ASI managing director Ron Chapman said.

Interference with aircraft transmission and

navigational equipment has proved the major obstacle to direct in-flight transmissions. This has seen the use of mobile phones banned on flights and caused an international scramble among computer designers to solve the problem.

"The new equipment is on-board the aircraft and allows it to receive stock market flashes and the latest news from anywhere in the world," Chapman said.

News available aboard Ansett or Qantas planes is delivered via satellite to the airport at which the plane is due to land and then downloaded from computer and replayed in-flight on video. Chapman said ASI's technology, the result of \$2.5 million spent on research and development, was invented locally and has a two-year head start on its major international rivals.

In aviation, Australia has been credited with

inventing the blackbox flight recorder and automatic landing gear.

Airlines in the United States, Europe and Asia have expressed interest in incorporating the system into their aircraft. "One airline in the U.S. is about to take it up, but there's a race on between U.S., European and Asian airlines to be the first to install it," Chapman said.

Under contracts awarded to ASI, through its U.S.-based subsidiary, the company will manufacture the hardware exclusively for the United States giant, COMSAT Aeronautical Services, in Washington. Passengers will either view the service on screens placed in cabins or on independent monitors fitted into seats. COMSAT is the major shareholder in the INMARSAT satellite network, which will deliver the information. ■

# Just Being 'Recyclable' Is Not Enough!

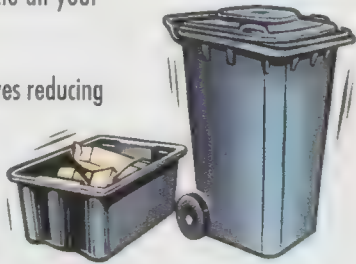
## IF YOU HAD TO DESIGN A NEW TYPE OF PACKAGE WHAT ENVIRONMENTAL BENEFITS WOULD YOU BUILD INTO IT?

How many times have you picked up a pack at a shop or supermarket and noticed it carried a recycling symbol or label claiming it is recyclable? Have you given it a mental "environmental tick" and said "Good, I'll buy that - its good for the environment - I can RECYCLE it when I have used the contents." Let us stop to think for a minute - is just being recyclable good enough? Or are there other ways of reducing environmental impact which do more to help reduce our impact on the environment? **What things would you look for in the design of an environmentally sound package?**

### CONSERVE RESOURCES

How often in the past few years have you heard that you must recycle all your packaging?

Recycling involves reducing waste by the collection of packaging materials after



they have been used so that they can be reprocessed into something else. Both the collection and the reprocessing uses energy and has other environmental impacts. Wouldn't it be better to have cut back on the materials used to make the pack in the first place? - to make that packaging from less material, less resources, thereby creating less waste. This is using the "Reduce" method and it is much more effective than recycling as the following example shows.

A brand of apple and blackcurrant juice is available in two types of pack - a one litre glass bottle which, together with its cap and label, weighs 400 grams and a one litre "long life" carton which weighs just 30 grams. A quick calculation shows that more than 92% of those bottles need to be recycled in order to use less material and make less waste than the unrecycled carton. Have you ever thought how hard it is to recover 92% of bottles? Experience tells us this just doesn't happen. It is better to reduce the weight, and waste in the first place by making **lightweight packaging** -

like milk and juice cartons.

**Rule 1 - PACKAGING SHOULD BE LIGHT WEIGHT TO CONSERVE RESOURCES AND REDUCE WASTE**

### BUT WHAT ABOUT THOSE RESOURCES?

As a society we are using more and more resources to service an ever increasing population. Many of those resources are non renewable and although they are plentiful now, they will run out. Wouldn't it be better to make our pack out of a renewable resource, a resource that can be replaced again and again - one that will never run out.



are the **only** containers for milk and juice that are paper based. The paper is made from forest waste from trees grown in sustainably managed plantation forests where, for every tree harvested, several more are planted.

*It is truly a renewable natural resource.*

**Rule 2 - PACKAGING SHOULD BE MADE FROM A RENEWABLE NATURAL RESOURCE**

### CAN WE DO MORE?

Are there any other environmental benefits you would like to build into your perfect pack? Wouldn't it be nice if the pack was degradable so it would not persist in the environment?

Paper based packaging, like cartons for milk and juice are degradable. They will break down in compost. It is a natural benefit that flows from using that natural forest resource in the first place.



**Rule 3 - PACKAGING SHOULD BE PAPER BASED SO IT IS DEGRADABLE**

### OF COURSE ALL CARTONS ARE ALSO RECYCLABLE

Milk and Juice cartons are also recyclable. They are being collected in major cities through kerbside collections and drop-off points across Australia. Collected cartons are taken to a paper mill run by Australian Paper at Shoalhaven in NSW where they are turned into paper for offices, schools and homes.



**Rule 4 - IF THE PACK CAN ALSO BE RECYCLABLE THAT IS ANOTHER BENEFIT**

# Designing Packaging For A Sustainable Future

IT IS INTERESTING TO SEE THAT WHEN YOU START YOUR PACK DESIGN FROM A NATURAL RENEWABLE RESOURCE HOW THE PACK HAS OTHER ENVIRONMENTAL BENEFITS AS A NATURAL CONSEQUENCE.

## FOREST SOURCED



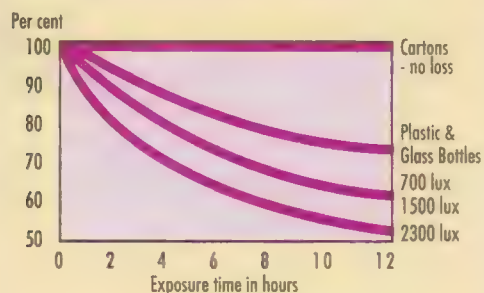
Cartons start their life in the forest. Plantation timber is grown to produce lumber for housing and furniture manufacture. The waste products of this forest based industry, unusable parts of trees, thinnings, bark, off-cuts and sawdust, goes to the paper mill. For every tree harvested, several more are planted ensuring this resource never runs out.

Simply follow the arrows to see how other environmental benefits flow from the fact that cartons are made from a renewable resource.

## PREVENTING LIGHT DAMAGE

### MILK NEEDS TO BE PROTECTED FROM LIGHT

Everyone knows that milk is an important source of calcium and protein. A lesser known fact is that milk is also important for vitamins.



Many scientific tests have shown the vitamins in milk are very sensitive to light. The above graph shows loss of Vitamin B2 under supermarket lights.



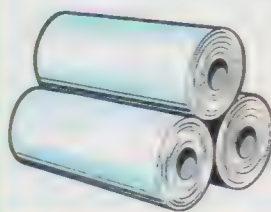
Milk is exposed to light in shops and supermarkets and can lose important vitamins. Only cartons give milk protection against light damage.

CSIRO tests show cartons keep milk cooler during times out of the fridge and between the supermarket and your home.

**REMEMBER - IF YOU CAN SEE THE MILK THROUGH THE PACK IT IS IN DANGER OF LIGHT DAMAGE. ONLY CARTONS WITH THEIR PAPER CORE CAN GIVE MILK ENOUGH LIGHT PROTECTION.**

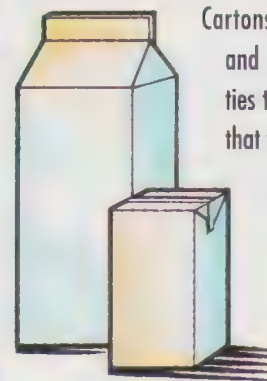
## PAPER BASED

Paperboard forms the core of every milk and juice carton. Long fibred pulp is used to give the carton strength and rigidity. It also allows the board to be creased into a carton shape.



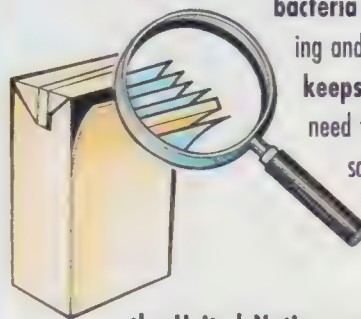
## CARTON PACKAGING

Cartons have environmental and food preserving qualities that come from the fact that their design is based on a renewable natural resource.



## LONG LIFE CARTONS PROVIDE ADDED BENEFITS

"Long Life" cartons have an additional layer of aluminium foil which acts as an air or oxygen barrier. The long life "UHT" process kills all the bacteria in milk or juice by quickly heating and cooling it and the long life pack keeps the contents fresh without the need for refrigeration - another energy saving environmental benefit.



**Did you know?** That the United Nations uses "long life" packaging to distribute a salt and sugar solution to children in Africa to combat dehydration and starvation.



# Sustainable Future

WITH A

## DEGRADABLE

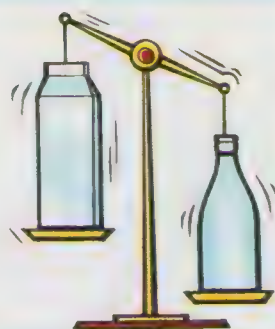
Because **cartons** are made from a natural material - wood - they **are degradable**, they do not stay around for ever. CSIRO tests have shown cartons can be **COMPOSTED** at home. Cartons have also been included in large scale Municipal Compost Programs.



## LIGHTWEIGHT

Because cartons are made from paper they are an extremely light weight and efficient form of packaging.

This produces extra **environmental benefits** - they take **less energy** to transport - require **less energy** to keep them cool - milk in a carton needs only a third of the energy to keep it cool - and make **less waste**.

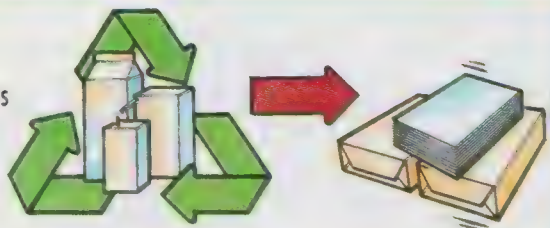


## RECYCLABLE

All cartons are recyclable. The collected cartons are sent to a paper mill where the pulp in the cartons is recovered and turned into quality paper for use in offices, schools and homes.

Because cartons are made from long fibred pulp they are a valuable recycling resource.

Cartons can also be recycled as compost or, like the wood they came from, safely burnt to recycle their energy.



## YOU CAN 'RECYCLE' CARTONS AT HOME

There are some environmentally positive things you can do with cartons.



**1. Plant A Tree** - Cartons make a good planter for seedlings - as the tree grows the carton disintegrates. Greening Australia uses hundreds of thousands of cartons each year as planters and tree guards.



**2. Compost Them** - Rip up your cartons. Wet the pieces thoroughly and add them to your compost bin - they will compost down in about 12 weeks.



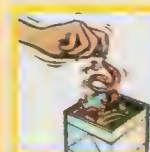
**3. Craft Resource** - Cartons make an ideal craft resource for young children and can be used to make handy items around the house - write away for booklet.



**4. No Grease** - Keep grease and cooking oil out of the drain - simply pour used oil into an old carton and put it into the rubbish bin.



**5. Recover Energy** - If you use a fuel stove for cooking or hot water, cartons can be safely burnt to recover their energy - remember they were originally wood.



**6. No Mess** - Use old cartons as a mini bin in the kitchen for vegetable scraps and add them to the compost.



For more information on the uses for cartons or their environmental benefits write to:  
ALC, P.O. Box 6250, North Sydney, NSW, 2059.

ALC

**CHOOSE LOW WASTE PACKAGING** Exercise your choice as a consumer by choosing products in packaging that has a **low environmental impact**. It is a better way of reducing waste than recycling because low impact packaging reduces waste up front rather than looking for ways to recover it later. Simply follow these rules.

**1. Choose low weight, low impact packaging** - preferably packs that also have another environmental benefit such as being from a renewable resource.

**2. Choose refill packs or concentrated products where possible.**

A choice of milk and juice in cartons is a choice for the environment even before they are recycled.

# The Forests That Go On Forever

## MAKING FULL USE OF A RENEWABLE NATURAL RESOURCE

### FARMING TREES SUSTAINABLY

Can you imagine planting more than 2 billion trees each year. This is the number of trees planted by the forest industries in Scandinavia and North America which supply the paperboard for milk and juice cartons.

It is no wonder that the forest areas in both these regions have been expanding. There are now many more trees than earlier this century.

A typical forestry program starts off with the planting of a mixture of trees native to the area. As the forest grows, which can take anything up to 80 years because of the cool climate, some of the smaller trees are thinned out to make room for the larger ones.

### PRIMARY PURPOSE

The primary use of these forests is the production of timber for use in housing and furniture manufacture. For example Australia imports oregon pine from mills in Washington State in the USA for timber house frames.

It is the scrap timber that cannot be used in this way that goes to the paper mill to make paperboard, rather than it being left to rot on the forest floor. This material represents about half of the total wood grown and consists of the crown of each tree, branches, the bark, any off cuts and saw dust from the saw mill, and the forest thinnings.



### PAPER MAKING

Waste timber from the forest is chipped and digested to make paper pulp which goes to the paper machine to produce paperboard.

In the process some waste materials such as lignin, a natural component of wood, are recovered and used as fuel for the mill together with any residual forest waste not suitable for paper making.

### MANAGING FORESTS FOR SUSTAINABILITY

These days in plantation forests you are less likely to see trees of one kind in rows. Rather you will see a mixture of trees, either planted randomly or the result of natural regeneration.

During harvesting stands of trees and selected trees in each forest area are left to grow old and provide habitats for native plants and animals. They are planned in such a way so as to provide connections between vegetated areas for animals to move around.

Management of these forests recognises that growth and decay are as natural to forests as they are to any other natural system, and forest management practices are designed to follow these patterns but make good use of a valuable natural and renewable resource - timber.

### ENERGY EFFICIENCY

An example of energy efficiency in the forestry industry is a paper mill in Sweden which supplies paperboard to carton manufacturers in Australia.

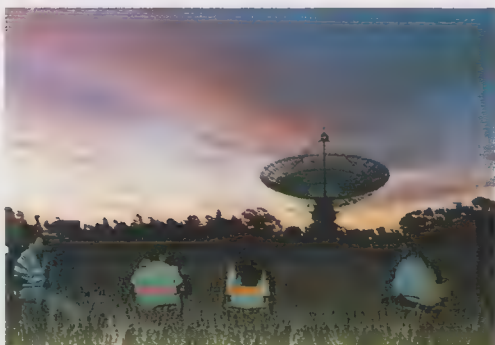
This mill uses the waste from the paper making process as well as unusable forest waste as an energy source. The energy produced is enough to power the paper mill and associated operations and to supply enough heat in the form of hot water and steam for

two thirds of the heating needs of a town of 75,000 people.

In Sweden's cold climate that is a great energy saving - energy that has come from a renewable resource rather than a fossil fuel.

# Prick up your ears

Capturing aliens on film



by Christine Williams

Ahead of the ambitious international search for signs of extra-terrestrial intelligence through the scanning of the sky for alien radio signals – or SETI – a crew of IMAX film-makers recently shot footage at the Parkes radiotelescope in mid-western New South Wales. Parkes will, early in 1995, begin preparing for the international effort.

Called *Destiny in Space*, the 180-degree “surround cinema” film is being produced for the Smithsonian Institution’s cinema-in-the-round dome theatre in the National Air and Space Museum in Washington, part of a series of three films which examine human space exploration. IMAX use the largest film frame available in motion pictures – more than 10 times the size of a conventional 35 mm frame – with projection onto a giant screen up to eight storeys high, giving the audience the sensation of being immersed in the film’s scenery.

On the advice of members of the scientific advisory committee of the Smithsonian Institution, the film’s producer, Phyllis Ferguson, came to Parkes to film the clearest view of the night sky that can be seen from Earth, as a complement to the footage of astronauts filming from space. Among the shots taken in space are six space walks preparing the Hubble Space Telescope for action, and work on the deploy-

ment of the Galileo space probe, as well as the daily routine of a shuttle astronaut.

“We trained the space crew to be self-sufficient in filming. The astronauts learn to load the camera, change lenses, load magazines, and record sound,” Ferguson explained. “They usually fly about 8 rolls of 1,000-foot film, and hand it over to us to develop and edit when they return.”

Director of photography James Neihouse trained the astronauts in IMAX filming techniques. He said the astronauts were the most alert students he’s ever taught, some even loading the IMAX camera without ever having seen it before.

“We give the astronauts a list of what we want filmed if a sight of certain parts of the Earth becomes available to them. They’ve taken quite a number of shots of Australia, which is beautiful from space, especially in its desert areas,” Neihouse said.

For the Parkes filming, Neihouse concentrated on the moon setting over the western horizon at dusk, as a transition into film of the starfields at night. “The best part of the galaxy visible from this part of the world is towards its centre around Sagittarius, where the brightest and greatest number of stars are found,” he said.

Before beginning to film, the crew consulted David Malin, an internationally acclaimed photographer at the Anglo-Australian Observatory, whose telescopes are located near Coonabarabran in north-western New South Wales.

Malin uses a method of treating film before exposure that makes it more sensitive for long exposures. “I bake the film in a moderate oven in a flow of nitrogen gas then give it a dose of pure hydrogen for a few hours,” he said. “This prevents what we call low intensity reciprocity failure, in order to improve the sensitivity of the film to low light levels.”

“There’s a sort of magic or alchemy in the process,” he said. “But it takes a certain knack you develop with experience to be able to slacken the wound film just enough so that the gas can

move across it. It’s important not to allow any kinks or marks on the film, and as this operation is going on in the dark, there’s a danger the film could suddenly unravel and you’d be surrounded by a mound of unwound film on the floor.”

Despite IMAX film being 65 millimetre, the crew were pleased with the results of Malin’s work, which allowed them to use exposures of up to 45 seconds per frame.

Dr Marcus Price, director of the Parkes radio-telescope, is looking forward to the SETI project getting under way next year. He said a search for extraterrestrial life could take two forms: eavesdropping on the chance that you will hit upon a signal; and a targetted search which concentrates on a very strong single-frequency source. The project has settled on the latter.

SETI scientists have chosen a portion of the spectrum between hydrogen and the hydroxyl radical, OH, which they believe is the best place to look for signals from other parts of the universe. Technically it makes the task easier, but also more logical – because hydrogen is so common in the universe, it would be the likely place to look for a deliberate signal.

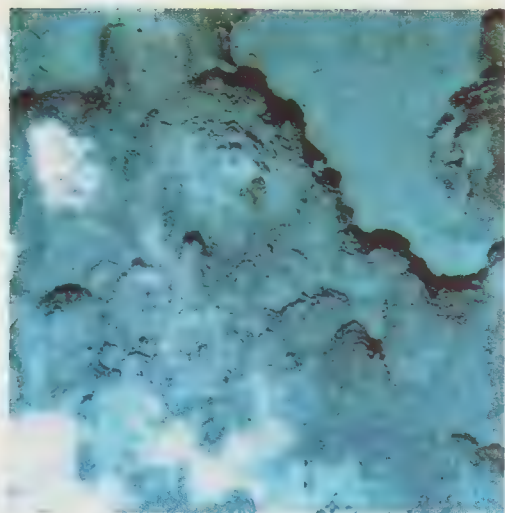
“This is the part of the spectrum that is the least affected by things you might expect around a planet, such as magnetic fields and particles which could interfere with lower frequency signals, and is still below the higher frequencies which need more and more sensitive radios and powerful transmitting equipment,” Price said.

“NASA built tens of millions of dollars worth of equipment for use by SETI before pulling out of the project last year. Since then, a private SETI Institute has taken over the project. About half the former budget has been raised from private donations, and the budget now stands at about US\$6 million per annum,” he said.

A special part of the SETI search has been set aside for Australian scientists. CSIRO have 12 staff on the project, but researchers from anywhere in Australia can apply to make observations.

# Heavy Metal

There's gold in them there volcanoes



CSIRO Division of Exploration & Mining

by Tim Thwaites

CSIRO researchers in Australia have found deposits of precious metals that are two to five times richer than those seen anywhere else on Earth. There's just one catch – they lie more than 1.6 kilometres beneath the sea. But with deposits this rich, undersea mining may be inevitable.

The ocean floor has long been one of the best sources for the world's fossil fuels. But while most of the minerals were created 3 billion years ago, a new fount of mineral wealth has been discovered in volcanic vents on the sea floor by a group of Australian researchers.

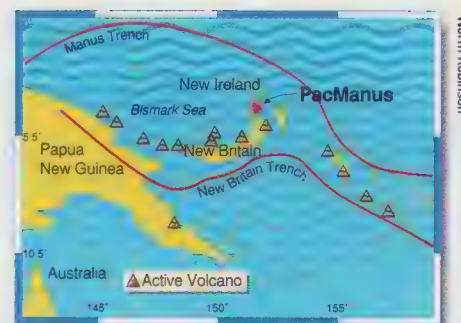
These mineral deposits, found in volcanic chimneys, are providing some of the richest sources of gold and silver together with high quality copper and zinc mounds, at a time when such ore bodies are becoming increasingly hard to find on land.

Working on the knowledge that most land-based ores were found in environments that had been continental margins, Dr Ray Binns and Dr Joanna Parr from the CSIRO's Division of Exploration and Mining in Sydney sought out underwater regions where tectonic plates had moved away from continental Australia.

In 1986 the group together with Professor Steve Scott from Canada's University of Toronto set out in the CSIRO's newly commissioned oceanographic vessel *RV Franklin* to the Woodlark Basin, off the southeastern tip of Papua New Guinea. Altogether they visited the Woodlark basin area three times, including a dive to the ocean floor in a Russian submersible in April 1990.

And the researchers found what they were looking for. Almost. It was a small mineral deposit, rich in gold, but the chimneys were made of barium sulphate, not the mineral sulphides in which they were interested.

So in 1991, the search shifted north to the Manus Basin, and here they have uncovered exactly what they wanted. Just back from a



Norm Robinson

trip in March on a German research vessel, they are delighted with their progress. "We have already made two very significant discoveries on the international scene. Now we have evidence of a third deposit in the region," Binns said. "We still don't know how large the original Manus Basin field is, but it is large enough to conduct trials to develop methods of seafloor mining."

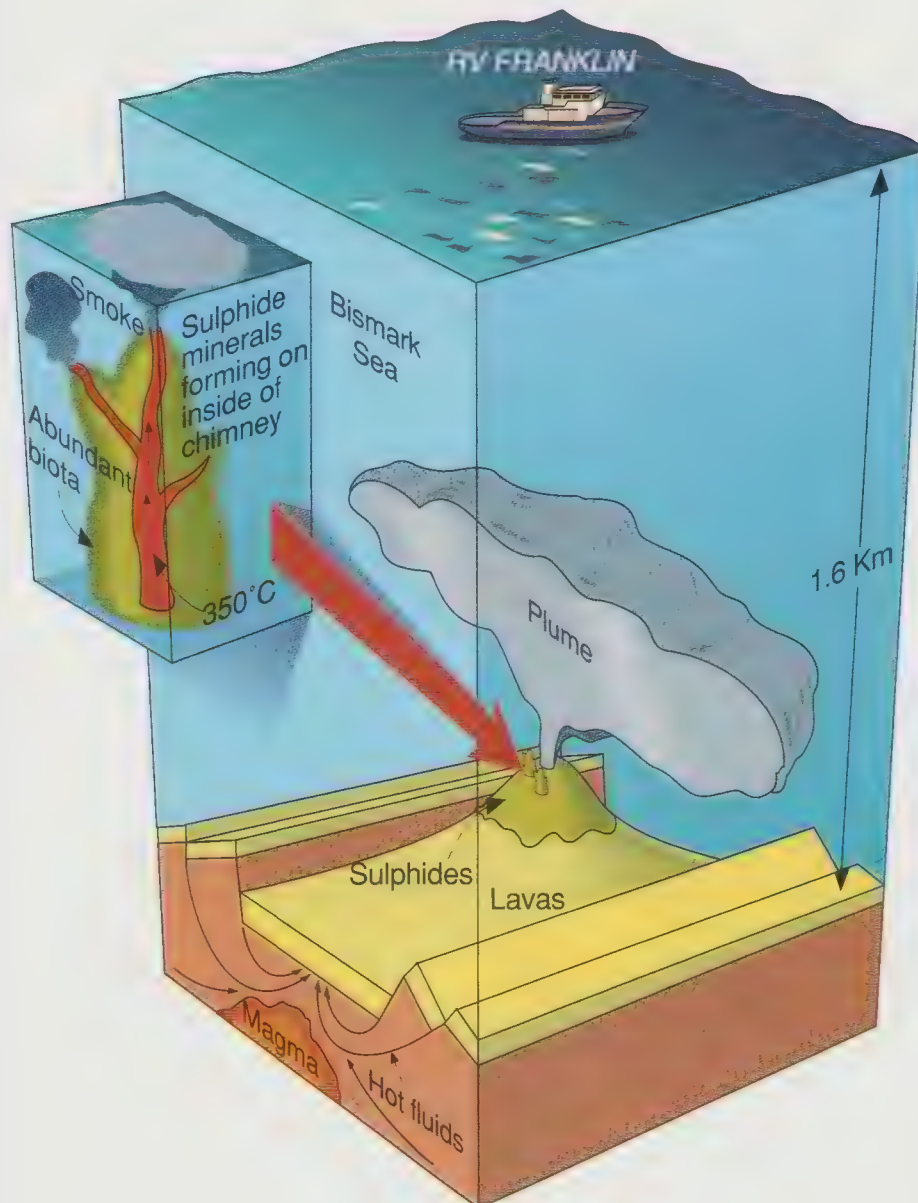
The group has another trip to the Manus Basin planned for 1995 using an American vessel and submersible. The expedition will be a collaboration between Australia, Canada, the United States and Papua New Guinea. Binns said the expedition would be aimed at determining how the ores are formed and what makes them so rich.

"We will collect fluids out of the hot springs, and at different points along the seafloor ridge, to give a three-dimensional assessment of what's going on. We want to find the sources of the water and the metals. Does the water come from the sea, or is it derived from the rock itself?

"The knowledge of what happens at very high temperatures and pressures is based on inference and calculations from laboratory experiments. Here we can look at the true elements of individual minerals and determine the effects individual fluids had on volcanic rock.

"We also want to look at the fringes of the deposit to help us recognise diagnostic criteria – fingerprints – which tell us where to find other deposits. Such information could help us pick deposits which are likely to be big, and that could save an awful lot of money in exploration," he said. ■

Some of the Earth's richest sources of gold, silver, copper and zinc are being found in volcanic chimneys 1.6 km below sea level.



# 21•C Back Issues

**BACK TO THE FUTURE:** The first volume (12 issues) of 21•C is available at discounted back issue prices. Buy any issue for \$8, a saving of almost 20% off the cover price, and have it mailed to you free of charge.

**No.1: INAUGURAL ISSUE.** Memory enhancing drugs; Green economics; Rising violence; The human genome project; Smart cars

**No. 2: ETHICAL FUTURES.** God and science; Peter Singer on animal rights; How the Gulf War effects the future; Antarctica's crisis; Living in space

**No.3: DREAMERS AWAKE.** (Stocks running out) Subconscious adventures in sleep; The green gauntlet; The answer to everything by Paul Davies

**No. 4: TECHNOFEAR.** The evolution of new language; Futurists: planning the future; The camera: photo fact becomes phantasy; Virtual reality; diving into dataife; The Australian Republic

**No.5 : GLOBAL PILLAGE.** Media monopolies; Nanotechnology; Dissecting the UN; J.G. Ballard interview; Energy crisis special report; Coping with the population explosion; Fred Hollows' vision

**No. 6: TOTALLY WIRED.** Determining a good leader; Robert Jungk: interview with the founding father of futures; Oliver Sacks on hallucinatory migraines; Charlatan or scientist: the controversial Rupert Sheldrake; David Suzuki on wisdom; Saving lives in virtual reality; Colonialism: the backlash; Heroes and heroines of science

**No. 7: WAR IS HEAVEN.** Supercomputers that save lives; Environmental auditing; Scientists bite back: revenge of the nerds; Cashing in on the clever country

**No. 8 : HEART OF BARTNESS.** TV sitcoms: the future is full of repeats; Technofear 2: nature vs science; Murder is natural: Jared Diamond interview; Artificial intelligence special report; The city of the future; The Club of Rome; Education: globalism and the future

**No. 9: THE END OF THE WORLD ISSUE.** The future of the apocalypse; Engineers with the right stuff; The CFC debate; Selling the president: media manipulation; Moral dilemmas of science; Technocop: fighting crime NASA style; Edible packaging and plastic cars

**No.10: BEHIND JAPAN'S MASK.** Silicon Samurai: How Japan became No. 1 in information technology; Creating robo-humans with artificial limbs; Cars of the future; Robotics

**No.11: GREENING THE BLUE PLANET.** Sustainable development special report; Hormone replacement therapy; Neutrinos; Global warming's economic impact; Superchips

**No.12: THE ELECTRONIC DREAM.** Alvin Toffler on information monopolies; The new pornography; Information technology special report; Bill Gates; Paul Davies; Cancer research; The birth of the universe

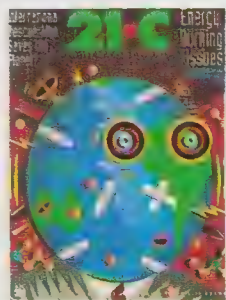
Simply fill out the coupon in this issue.

No stamp is required.

Any further subscription or back issue enquiries: call Rhonda Fitzsimmons toll free on 008 224 018



4



5



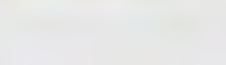
6



7



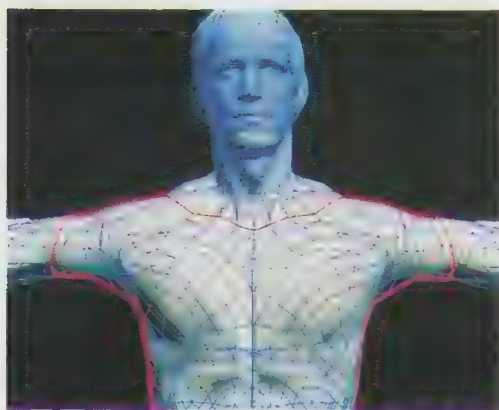
8



9

# Synthetic Cinema

Film without actors



by Adam L. Penenberg

Is the future of cinema an endless run of cyber-sequels to 'Casablanca' filled with virtual actors? Motion-capture, a melding of film and computers, holds a lot of potential, but also raises a lot of questions.

What if a film director hollered "Lights, camera, action!" and not only did the actors not pay attention, there were *no actors*?

Although today this scenario would cause a certain amount of hand-wringing, temper tantrums and frantic calls to agents, with the approach of the new millennium it's only a matter of time before technology will be able to render human actors obsolete.

Sounds far-fetched? Already digital technology has resurrected dinosaurs for the mega-hit *Jurassic Park*, melted and resolidified Arnold Schwarzenegger's arch nemesis in *Terminator 2*, and concocted increasingly more realistic video games. Two Swiss researchers have even produced a short film with synthetic actors, starring Humphrey Bogart and Marilyn Monroe, both of whom have been dead for decades.

And the new technologies don't stop at resuscitating the dead. They have the potential to blur the lines between the real and the imagined. With computer graphics and "motion capture," a film-maker can transform digital data into images that look, act and sound like a human actor. Any actor — real or imagined.

But, death to gossip rags notwithstanding, what will be the ramifications of relying on synthetic actors? Will Hollywood, after the technology becomes cost-effective, begin to churn out films bereft of actors, leading to a glut of waiters, waitresses and office temps? Or will film-makers absorb these technological changes by mixing media, combining real actors with computer-generated ones? Might it even see a challenge to the dominance of Hollywood from outside of Tinsel Town, maybe even outside of the United States?

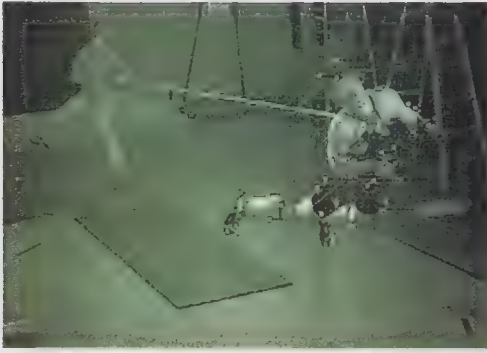
Although no one knows for certain, odds

The Thalman's are working on a new film, to feature James Dean, Elvis Presley and the digital return of Marilyn Monroe.

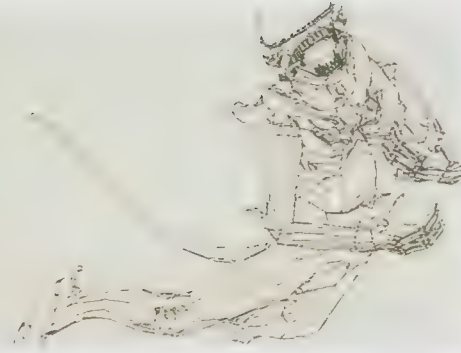
are that, in the near future, films of mixed-media will win out.

"I think you'll see more dead actors interacting with live actors in the near future, actors who were popular in the past like Humphrey Bogart and who still have name recognition," says Joseph Beard, a professor at St John's University School of Law in New York.

This desire to exhume the dead is not new. Indeed, in *Dead Men Don't Wear Plaid*, Bogart and Charles Laughton were made to appear as talking with Steve Martin. This film technique is limited, however, relying as it does on existing footage being spliced into new film, which means that dead actors cannot do or say anything that hasn't been done or said before. But new technology will enable



Data Life: creating computer actors via texture mapping



Acclaim Entertainment Advanced Technologies

film-makers to invent wholly new situations.

Which opens up a Pandora's box of legal questions. Who owns the rights to a dead actor's image? What would be the legal hurdles of bringing back Bogart to co-star with, say, Skippy the bush kangaroo and Elle MacPherson in a remake of *Casablanca*. Or worse, a sequel to *Casablanca*. And what if, God forbid, Bogie gave a lousy performance?

One possible answer is that even though computers translate data taken from old footage covered by copyright, the data themselves are merely facts, not protected by copyright law, leaving film-makers the legal right to create freely.

"With living actors you would need permission, the same as if I used your picture in a magazine article. If it's parody, then you get into some interesting questions," says Beard, who specializes in entertainment law. "With dead actors, it gets more complicated."

The only thing certain is that the law will have to move aggressively in coming years to sort out these issues. But in the meantime, technology marches on.

Seven years ago, Daniel and Nadia Thalmann, two Swiss scientists, produced the first short film featuring computer-synthesized actors. The film, *Rendezvous at Montréal*, featured two renowned dead actors, Marilyn Monroe and Humphrey Bogart. Although the film was a technological breakthrough, the performances were less than award-winning.

"It was a short movie, about 7 minutes, in which we tried to recreate Marilyn and Bogart," says Professor Thalmann. "They could smile, speak, grasp objects and walk. The facial animation was difficult because of the number of muscles and movements."

The technology involves a software program they invented, which enables them to issue direct verbal commands to their actors. Dialogue is recorded the traditional way, except that the computer automatically synchronizes the movements of the lips and mouth to the sound.

Since the film was produced seven years ago, the technology has advanced significantly. Now, the Thalmanns are working on a new film, to feature James Dean, Elvis Presley and the digital return of Marilyn Monroe.

"We are near making people realistic," he says. "Not to say we can create any person in every situation. Some motions are easy, like grasping an object, reaching out with a hand; others are more difficult, like walking, dancing, playing sports or games, which involve a lot of joints. It's also difficult to get skin tone perfect."

Perhaps some of the answers the Thalmann's seek may be found in, of all places, video game technology. The multi-billion dollar video game industry, which dwarfs the film market, has also been quick to embrace new technology, although researchers in this field, in their quest to create ever-more life-like games, often come from the perspective of animators rather than film-makers.


At Acclaim Entertainment, the world's largest independent video game software publisher, researchers have been combining animation, video and digital technology to compile a database library of synthetic actors and motions. The company, which has published blockbuster hits such as *Mortal Kombat*, *N.B.A. Jam*, *The Simpsons* and *Terminator 2*, can call on these characters and motions for use in video games.

"Motion capture looks more real because you don't have to sit here and say to yourself: 'How would the human body interpret this move?'" says Paul Samulski, Acclaim's vice president of research and development. "If the right arm moves, it moves in a believable fashion. It's not like an animator said, 'I think it moves this way,' and you find out they moved it with the elbow tucked in rather than out."

The process begins with scanning an actor's image, then "texture mapping" to create a three-dimensional character. The data are then digitized and dumped into a computer system, which applies this information to a wire-frame skeleton used to drive a mesh-like skin. Detailed hand and facial gestures are applied, torsos expanded or shrunk, muscles added or subtracted – so much so that the finished character may look nothing like the original model.

With motion capture, it really is possible to have the body of Mel Gibson, and the mind – or at least the head – of Woody Allen.

Both computer-graphics and motion capture still have a ways to go before they will be able to replace real actors. Computer graphics have trouble grappling with complex motions, and motion capture, although superior from a motion perspective, must shed its own 'cartoon' glow. But for the same reason digital recording has virtually supplanted analogue, digital actors may replace real ones.

But this isn't how Thalmann sees it: "Synthetic actors will not kill cinema. They will add to it. It will be great for interactive films and TV. If you have a real actor, it's difficult to interact with him. But if he's synthetic, then you can play with him. And that's what people will want." 



'Pixel Pointilism': Bill Gates takes an afternoon stroll through Georges Seurat's 'La Grande Jatte'.  
Computer manipulation by Diane Mantzaris

## press enter for art

By Corey S. Powell

To Microsoft supremo Bill Gates, art is more than colour on canvas: it is information fodder for the digital memory banks of the future, where galleries are dial-ups and the brushstrokes digital.

Bill Gates, the boyish multi-billionaire founder of Microsoft Corp, is not the sort of guy you would expect to revolutionise the art world. But during the late 1980s, Gates, like a long line of mega-magnates before him, took an interest in art.

But unlike his predecessors, Gates saw art through eyes accustomed to the digital world that made Microsoft an economic giant. To Gates, art is much more than paint smeared on canvas or sculpted bits of metal – it is information fodder to fill the ravenous memory appetites of future computers. With that realisation, Gates immediately booted himself into the cybertide that is starting to inundate the art world.

In 1989, Gates dug into his deep pockets to create Interactive Home Systems (IHS), a company who's devoted to collecting the digital rights to the great works of art around the world, transforming pictures into electronically digitised files that a computer then reassembles into a visual image on a video screen. Although Gates was convinced, Microsoft's board of directors, smelling no scent of profit, weren't so sure, and declined to fund his venture.

Gates initially asked museums for exclusive rights to sell their digitised images in exchange for a small, one-time fee. Not surprisingly, he found no takers. Museum employees privately whisper that they were put off by the brusque and uninformed attitude of some IHS representatives.

## Gates has envisioned his new home as a technology showcase where high

"You can call it cultural imperialism – whatever – but that's not the way those people see it," laughs Ben Davis of the Massachusetts Institute of Technology. "IHS was out to corner the market; that's what a company does."

IHS then adopted a kinder, gentler approach. It changed its name to Continuum Productions and now shops mostly for non-exclusive rights, although a few photographers have signed exclusive contracts.

Continuum has also sharpened its art world connections, even snaring J. Carter Brown, the former director of the National Gallery in Washington as a consultant. Brown breathlessly proclaimed Continuum's work to be "the next wave, the future of education in the arts and a look ahead into the 21st century".

Continuum has approached nearly every major museum and collection in the U.S., striking numerous deals: with the Seattle Art Museum, the National Gallery in London, the Barnes Foundation, Philadelphia Art Museum, and the State Russian Museum in St Petersburg. It now has some 150,000 images in its memory banks, about 25,000 of which are fine art. Other digitised holdings relate to science, music, history – a cross-section of Western culture.

Where do you see digitised art? One likely, though rather inaccessible, place is Gates' upcoming US\$350 million, 28,000-square-metre mansion, now under construction on the shore of Lake Washington. Gates envisions his new home as a technology showcase, where high-resolution video wall screens tap into a vast visual library.

"Art is not something I'm an expert in today, but I think with a system like this I'll be able to understand it," Gates told *The Guardian* in 1992. "I'll also be putting up nice pictures of sunsets or maybe I'll be trying to learn something from pictures of all the presidents or different types of planes or cars or plants."

Despite Gates' ostensibly naive attitude to "nice pictures", he would not be in the multimedia market unless his ruthless business sense told him that there is money to be made. Steve Davis, Continuum's acting director, explains that the vast digital image collection will form the core of two products: a "commercial licensing product" – essentially a multimedia stock agency – and a series of databases of art work, photographs, and descriptive text. Eventually, Davis hopes to make these databases available to the public, through CD-ROM or an electronic network.

Two years ago, the Seattle Art Museum unveiled "ViewPoint" an interactive 'kiosk' system developed by Continuum's digital wizards. The kiosk is an interactive, touch-screen computer that lets a visitor browse through the museum's holdings, like the computerised directories in shopping malls. Continuum developed ViewPoint to show off the potential of the company's rapidly growing image database. The National Gallery in London recently installed a similar setup, called Micro Gallery; a sister project is underway at the National Gallery in Washington. Other museums are also developing computer-driven kiosks to explore their collections.



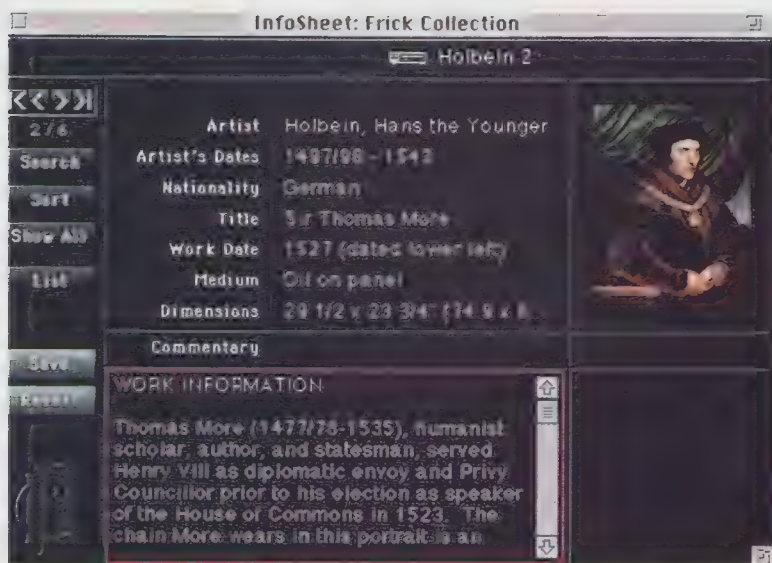
Helen Abbott, manager of publications at the Seattle Art Museum, is excited by the power of ViewPoint to "demystify the museum, especially for young people". Other museums echo similar lofty expectations for interactive computer stands. Vicky Porter, the curator of the upcoming Micro Gallery at the American National Gallery, hopes that "people will bring a new sense of wonder" to the museum as a result of digitisation. But interactive art kiosks represent little more than a friendlier repackaging of existing reference room sources. Digital art is sure to have a far greater impact as it migrates out of the museum and into the street, where its meaning and uses become more complicated. The London Micro Gallery has already spawned a commercial CD-ROM, simply called "Art Gallery" and marketed by none other than Microsoft. The CD-ROM repackages the images and text from the museum's kiosk. But Gates does not have a lock on the art software industry – at least, not yet.

Digital Collection Inc sells CD-ROMs featuring works from the Frick Museum in New York and the Price Collection, which will eventually reside at the Los Angeles County Museum of Art. Many other CD-ROM publishers are keeping the market in flux, and museums are, on the whole, carefully hedging their bets.

"We've been approached by a lot of people. We're not doing anything that is either permanent or difficult to back away from," says Charles Moffett, director of the Phillips Collection in Washington.

Using Microsoft's Art Gallery feels rather jarring at first. People expect to see art on the walls, on posters or in books. The luminous video quality

resolution video screens on the walls would tap into an art-historical library



Software manufacturers have been racing to secure CD-ROM rights to the world's museum collections. Digital Collection Inc. features art works from New York's Frick Museum.

of the computer screen makes Holbein's *The Ambassadors*, for example, look like it is made of stained glass. The crude resolution of present video monitors replaces brushstrokes with cathode-ray tube pointillism. Some critics not unreasonably argue that CD-ROMs degrade the image of the art.

Most museums seem firmly convinced that familiarity increases interest in the original artwork.

A more serious concern involves retaining control of electronic images. One startling feature of Art Gallery – and of any unprotected CD-ROM system – is that it allows users to pull the images off the screen and manipulate them. Drawing a moustache on the Mona Lisa has never before been so easy. Of course, defacing reproductions of great art is hardly new – what is new is the ability to create, save, and erase the changes, and to tap into a ready-made set of tools for manipulating them.

Museum legal departments are still coming to grips with the implications of digitised artworks. Porter reflects that museums still have about as much control over art images as they did before the advent of CD-ROMs, "which is – not that much control!"

Museum legal eagles will have to develop standards for electronic rights infractions they wish to pursue. Although museums do not prosecute everyone who photocopies *Guernica* in, say, a give-away fanzine, digitised art is another matter. "I don't know that there is a solution. Legally, you just go after the biggest offenders," says Alan Newman, executive director of imaging at the Art Institute of Chicago. Museums may try to attach copyright tags to images they post on Internet, as the Smithsonian is

doing with its service available through America On-line, a leading computer bulletin board.

As technology gallops forward, images will be more widely available and the fineness of detail will improve. And, as Ben Davis points out, digitised art "is a medium you can literally do anything with: it's transmissible, it's alterable, you can make new art out of it".

Already, lawsuits are blooming over the appearance of pirated cartoon characters and scanned-in *Playboy* nudes on Internet; manipulated fine art images are also beginning to show up. The most computer-literate museum employees are starting to recognise that high-resolution digital art images will have to be encrypted, or coded, so that only authorised users can look at them. "Museums just kind of woke up to what's going on," says Davis.

Last August, Continuum was partially absorbed into Microsoft, a sign that the parent company now sees big money in Gates' techno-vision for digital art. There are already 30 million CD-ROM-equipped computers in the United States alone; last year, some 5 million CD-ROMs were sold. Museums are already in the thick of a fight to see who will tap into that market. Concerns already abound about Gates' attempt to corner the market: the U.S. Department of Justice is investigating Microsoft for its alleged predatory business practices.

"The computer makes capitalism very transparent – it's all about property rights," Ben Davis reflects. "The problem is, the museums don't see themselves in the art information business." ■

# ***The Dark Avenger***

by Nico Krohn

A crazed technopath is hacking into the computer systems of the world, and there are millions of disasters going down in the Naked Network. Who is the shadowy figure with the deadly moniker Dark Avenger?



Dark Avenger's viruses systematically destroy data. They work so invisibly that they often go unnoticed by users until most of the data has been wiped out.



It had all the makings of a spy novel. A woman from a small mid-western U.S. city, a furtive electronic correspondence, and a Bulgarian computer hacker so secretive no one knows his name.

Born at the end of an era that produced a plot to assassinate the Pope with a poison tipped - umbrella, the Bulgarian who came to be known as Dark Avenger had a fatal weapon of his own: computer viruses. His small, contagious programs are among the most clever, and destructive, in the world.

Dark Avenger is credited with building the world's first fast-infecting virus, which quickly infects every program on a computer. He also created the first virus to slowly and invisibly eat away at data, a virus that could go undetected until little data was left. But his most threatening work wasn't a virus at all. Called Mutation Engine, it is a set of tools for designing viruses that change appearance as they spread, making them almost impossible to detect and eradicate.

"He's perhaps the best known and least understood virus author," says Sara Gordon, whose two-and-a-half-year effort to track down Dark Avenger became something of an obsession.

Most computer viruses aren't intentionally damaging to data. A sliver of code surreptitiously buried in a program on a floppy disk attaches itself to the tail-end of a program on a computer's hard drive, where it lies in wait. Activated by a regular program's use, the virus goes into action, copying itself to healthy programs, typically playing a tune or flashing a message across the screen from time to time.

But Dark Avenger's viruses systematically destroy data. They work so invisibly that they often go unnoticed by users until most data has been wiped out.

Gordon was intrigued by this mysterious figure from the time she first noticed his name on an international electronic bulletin board. Who is he? she wondered. Why did he write his first virus? Is he a crazed technopath, or a maniac intent on destroying the world? Gordon, a Chicago-area computer-security specialist with a background in juvenile corrections, made it her mission to find out.

A computer she had bought in 1989 came with a relatively harmless virus. She knew nothing about viruses, or how to get rid of them, so she logged on to a Fidonet virus forum. There she noticed a lot of users writing about someone known as Dark Avenger. They wrote that his viruses were the most crafty around, and speculated about the strings of text he sometimes embedded in his work, such as "Eddie lives... somewhere in time," and "Diana P." Intrigued, she began to participate in the forum, long after her own virus was gone.

Her search followed the efforts of some of the leading minds in computer virus research. Initially, much of her work involved rediscovering things those who had gone before her already knew.

Vesselin Bontchev, 33, a quiet, serious PhD student at Hamburg University first noticed Dark Avenger in 1989. Bontchev has spent five years researching Dark Avenger's viruses, painstakingly dissecting each one and publishing articles about them in a Bulgarian computer magazine. Bontchev and other virus researchers gathered clues about Dark Avenger's personality and financial problems from the brief texts he sometimes planted in his viruses and the messages he occasionally left on electronic bulletin boards.

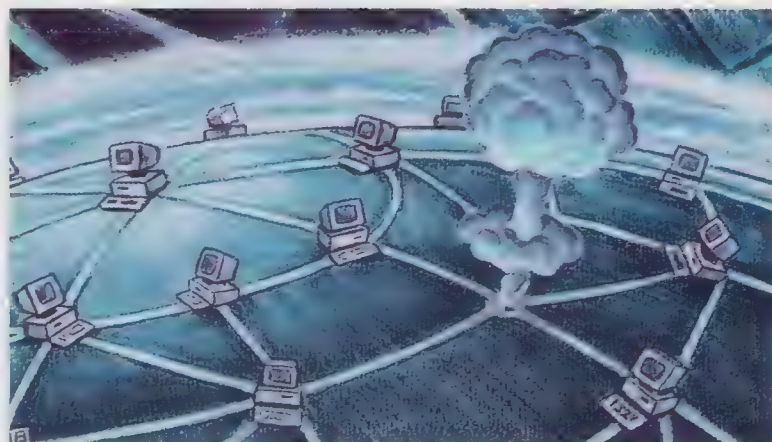
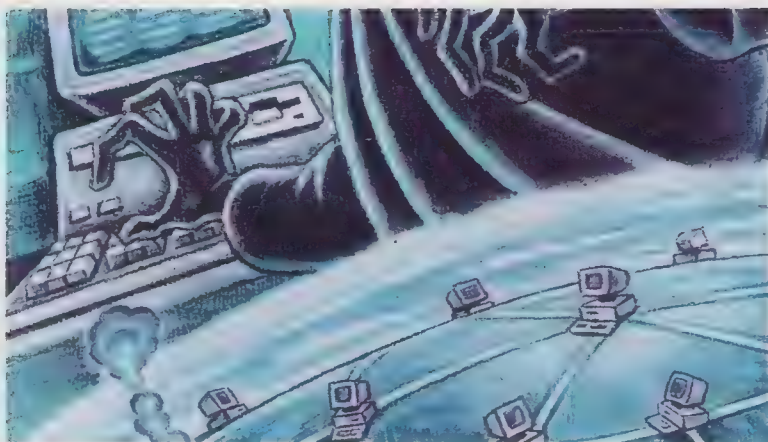
Bontchev has developed a theory as to why his homeland and Russia are the birthplaces of more computer viruses than anywhere else in the world. Most virus researchers agree that about 10 per cent of the world's viruses have originated in Bulgaria. Under COMECON, the old Communist common market, Russia and Bulgaria were charged with manufacturing PCs for the entire Eastern Bloc. As a result, universities started pumping out lots of highly qualified computer engineers – far more than the industry could absorb. Lacking productive work, these engineers often turned their attention to cracking copy protection on Western software, and other forms of hacking, including virus writing.

But even as Bontchev was developing a reputation as Bulgaria's foremost virus expert, his colleagues were perplexed by his zeal for Dark Avenger lore. A rumour began to ripple through computer underground circles. Maybe Vesselin Bontchev was Dark Avenger, a brilliant scientist turned renegade.

It was something Gordon wondered about too, and it took her more than a year to be sure he wasn't. But before she had formed any definite conclusions, she came across another computer expert who had stalked the secretive Avenger.

Dr Alan Solomon, chairman of S&S International Ltd, a Berkhamsted, U.K.-based anti-virus software company, uses some unorthodox techniques to neutralise viruses. These methods include calling the virus writers on the telephone to chat about why they're writing programs that can damage other people's data.

"Virus authors love talking about their viruses, and themselves," says Solomon, who finds their names in a variety of ways. Some are "so boastful that they practically tell you who they are and where they live," he says. For example, they occasionally log on to bulletin boards using their real name. Then it's merely a matter of looking them up in a phone book. Sometimes it's more complicated. One virus featured an insult that named



another hacker. Solomon identified the insulted party and some of his friends. Under questioning by Scotland Yard's Computer Crime Unit, the friends implicated the guilty party.

Solomon's accomplishments, however, don't include any contact with Dark Avenger. "He's very shy," the doctor says.

For all his efforts, Solomon has developed only a meagre profile: Dark Avenger is probably under 30 – like 99 per cent of virus writers, Solomon notes – a fan of the heavy-metal rock-music group Iron Maiden, and very angry about something. But what?

Judging from the failures of such experts, it began to dawn on Sara Gordon that she might never succeed in her quest. And she might have been right, but for one thing. Dark Avenger himself had been following her various queries about him and the science of viruses on Fidonet. In fact, early on in her search, hoping to attract Dark Avenger's attention, she put out some bait, remarking that she would like to have a virus named after her. After this, Dark Avenger apparently took a shine to her.

Had she known more about viruses and the damage they can do, Gordon says, she never would have made such a request. But if she hadn't, she probably would never have made contact with Dark Avenger.

In early 1992, Dark Avenger made Gordon an odd sort of present: a tiny demonstration virus with an inscription that read, "We dedicate this little virus to Sara Gordon, who wanted to have a virus named after her." The virus, code-named Dedicated, was posted on an electronic bulletin board called Dead on Arrival (DOA), along with Dark Avenger's trade-mark Mutation Engine.

But even then she found it difficult to make contact.

She spent hours composing a brief letter in Bulgarian, with help from a library dictionary. Then, to avoid being taken in by one of the many characters who pretend to be the Dark Avenger, she sent the letter to a U.K. bulletin-board operator believed to have been in contact with the genuine article.

A month and a half later, the Bulgarian finally replied through the intermediary with an electronic message: Scan a photo of yourself into a computer and transmit it to me.

Gordon, more intrigued than ever after two and a half years of fruitless searching, sent the photo almost immediately. The next day she waited for a sign that it had been received. At last the phone rang.

A long silence, then her line went dead.

When Dark Avenger did reply, it was another electronic message passed through the U.K. bulletin board. Its tone was mocking. "Don't you have colour scanners in America?" he asked.

Gordon persisted. A day later, the two had their first electronic conversation through a U.S. bulletin board, though Dark Avenger routed his messages so they would be untraceable.

"Why didn't you ever contact me?" Gordon asked.

"I did!" answered the Avenger. "I left you a message once. Well, it was not to you, but I put something in it for you."

"Yes, I remember that one. Something about, 'You should see a doctor, normal women don't spend all their time talking about computer viruses.' I answered it, if you will recall," Gordon replied.

"Yes. You said, 'I do not want to be a normal woman, at least not in Bulgaria.'"

Slowly, in subsequent conversations ranging over a period of months, Dark Avenger told her about Bulgaria and the frustrations of his life there. He wrote of Sofia's recurrent power failures – a problem that is now solved – long food lines, corrupt officials and few challenging jobs for talented young programmers. "It is a swamp!" he wrote. "The rest of the world treats you as if you are nothing if you are from here."

Though he never revealed his true identity, Dark Avenger explained to Gordon that writing viruses was for him a small act of revenge against a society he despised. It made him glad, he said, to write programs that would travel to lands he himself would never see.

"I liked it a lot seeing my things in Western anti-virus programs," he told her. "Perhaps more than just liked it. I was excited; happy – for the moment." Asked if he had any idea of the damage his viruses had done to people and their livelihoods, he said no.

In Bulgaria, he said, PCs were just hi-tech toys, status symbols with little practical value. He expressed frustration with his own relatively unsophisticated equipment. It wasn't clear whether he was employed.

At one point Dark Avenger promised Gordon he would write no more computer viruses. He let her publish the pledge, along with some of his electronic correspondence in *Virus News International*, an industry magazine funded by Solomon's S&S International. Eighteen months later, his promise still holds, but the question remains: Is his remorse just a sham? Will he take up his craft again? Bontchev thinks so. Solomon doubts it.

Gordon admits she can't be sure. But the bitterness in his words still echoes from an early conversation:

"In American movies, at the end, the good guy always gets the money, the girl, and the applause... But in real life it's not clear who is good and who is bad.

"And who gets what? It's not black and white. The only thing that is for sure is that good people always lose." 216

539 1900 24357 70795912 56372951

Digital p

CODE

turn on  
to

of a future

acts of computer intelligence

by McKenzie Wark and Rosie Cross

It has no physical place in space. No one controls it. And yet, like a global cafe of ideas, people dip in and out, talking, thinking, meeting, scheming, playing. Every day, millions of people paddle into the digital sea of data that is the Internet, the global computer/communications network that is shaping the post-TV age and challenging traditional power structures.



# Surfing the Internet

The Internet is the biggest step towards a democratic communication media since the telephone. In principle, if you can read and write, and remember a few commands, then you can not only read what you like from wherever you like, you can also send messages to anyone, anywhere. Like any new media, this one has its teething problems, but the real problems are more social, cultural and political than technical.

**21•C** plunged into the Internet, tracking down some key thinkers along the way: Bruce Sterling, author of *The Hacker Crackdown*; Amy Bruckman from the Media Lab at the Massachusetts Institute of Technology; John Perry Barlow, co-founder of the Electronic Frontier Foundation; Dale Spender, Australian feminist author; Robert David Steele, U.S. Marine Intelligence Officer; Geoff Huston, technical manager for the Australian Academic Research Network, the local Internet set-up; Anna Coney, founder of the Arts Wire Services in the U.S.; Elizabeth Reid who did her masters in cultural studies on MUD's and MOO's at Melbourne University, and Elise Mathessen who lives in Minnesota and takes her coffee breaks in California, and is an experienced net-cruiser.

What's e-mail? What's IRC? Read on and find out.

**McKenzie Wark:** Every morning I turn on my computer and log on to the Internet. Usually I just check my e-mail, but sometimes, if I feel like it, I go surfing in all the weird and wonderful data out there, being passed around the thousands of computers that the Internet joins together all around the world.

**Bruce Sterling:** It's very difficult to get your bearings in the world of cyberspace. It really is a place of fun-house mirrors.

**Wark:** The Internet is a way of getting information on just about anything! If you wanna find out something on particle physics or something about trout fishing – it's out there – and with half-a-day's training you can go and find it for yourself. Or you can just surf, paddle about in pools of data looking for the next wave of cool information.

**Sterling:** People are always asking me, "Gee, Mr Sterling, what's this cyberpunk thing all about?" Now I can tell them "look, get on the gopher at tic.com, ok, they got a megabyte of stuff there, you read that; if you don't know what cyberpunk is after that YOU'RE BRAIN DEAD, OK!" Tell them to turn off the oxygen.

**Wark:** Another neat thing about the Internet is that it connects with an amazing amount of cool people, whether you're interested in the temple dancing of southern India, or supercomputing, or S&M sex, you can find people on the Internet who are into such things.

**Elise Mathessen:** There's so much information out there it's like walking into Ali Baba's treasure cave. There's treasure chests of jewels and diamonds lying all over the floor, you don't know which one to open first.

**Wark:** Once you've been surfing for a while, you meet the people whose Silicon Beach it is.

**Mathessen:** I have known people to fall in love over the Internet without ever seeing anyone's faces.

**John Perry Barlow:** Cyberspace has really been with us ever since Alexander Graham Bell [inventor of the telephone] and his assistant Watson had a meeting back in 1876.

**Wark:** What does it feel like to be out there surfing on the Internet?

**Mathessen:** Well, one of the things that works well for me is specific to my situation. I'm hearing impaired... I wear a hearing aid. But when I'm on the Internet, everything is in print – and I hear print just fine. I've always been a big reader and I like having all the words on the screen, I don't-

miss anything in the conversation, I can talk to anybody and I'm not disadvantaged – which is a little different from daily life.

**Wark:** Elise Mathessen hangs out in places called Muses.

**Mathessen:** Its like living in a story book. You log on and you're a character in a story, and you walk around and talk to other people who are logged on from other places, who are characters in a story, and one of the neat things was that I ran into a bunch of other people who were deaf. One was a young woman from England, about 14, who had just found a muse, and it was really neat 'cause we spent some time chatting about what it was like for us. And yet we met in this electronic fantasy world that comes out of a machine at MIT in Boston. There was a cartoon in *The New Yorker* that has two dogs sitting at a keyboard. One of the dogs says to the other, "its great on the Internet – nobody knows you're a dog".

**Wark:** With all these people, and dogs, hanging out on the Internet boardwalk, communicating for the most part in pure written text, do they ever come together as a community or is it just a bunch of random atoms colliding?

**Barlow:** Community really arises to a large extent in response to shared adversity. Unless you count UNIX [Internet's complex operating system] as shared adversity (*laughs*), which I certainly do. But, it ain't no Amish barn-raising in there, not yet. So much depends on inter-relatedness based on necessity, like in a small town – you need each other. In cyberspace you don't really *need* each other, it's not like a life or death matter, and there aren't real good ways to communicate emotional information or cultural information. There are just a lot of things that are missing at the moment and it's going to take a while for them to emerge.

**Wark:** You can dip into the Internet to play or go to work. Some don't consider there's much difference between work and play on the Internet, when what you do is live and breathe information.

**Sterling:** Most days I do very little. I get up and take my kid to the local scholastic gulag, and I read the tonnage of specialised magazines that shows up in the house. Maybe I mosey down to the university and pick out a few odd 19th Century tomes, then I go hang out at the local cool bookstore and see if any bizarre postmodernist tattoo mags have arrived. Then I'll come home and log on to my Internet account and deal with the megabyte of fan mail, various electronic publications I get every week, and if I see something that's really interesting, I generally cut and paste it out and fax/modem it to 30 other people – just sort of keeping them up-to-date. Then I'll go in and hang out with the usual magazine publishers on the WELL. The bOING bOING conference. *The Whole Earth Review* conference. I'm pretty tied up with these people now and it's like a giant electronic Bay Area Coffee Shop, we're all sitting there busily trading ideas and puffing one another basically. Then I'll log off and try and save some of my mail and deal with it, and throw the rest in the trash and try not to be crushed under my toppling heap of data here. And then, possibly, I might write something.

**Dale Spender:** I used to get into bed at night at about 11 and read books. What I do now is turn on my computer and get on the nets. I've one particular friend with whom I'm editing an international database and because we send each other e-mail messages just about every night, I never feel as though I've lost contact. It's this sort of fun thing that replaces my reading books, and it's a real intellectual smorgasbord. Particularly for people who have been about information production, suddenly seeing that there are 46 new messages/items on the women's studies bulletin board – am I going to let myself go into them and find out what's there or am I going to be disciplined and just do my 37 new e-mail messages, and go through some of those? It's this sense that sitting there in my study is access to the information of the world.

**Wark:** But will the Internet ever become a mass medium or will it remain the private beach of an expanding, but elite, information class?

**Sterling:** I want to be able to see things I have no business seeing and

## “Technology definitely has politics and they are anarchistic in nature”

think about them. I don't want my life or thoughts to be regimented. I'm a person with a very hungry imagination and my imagination needs constant feeding, from the least likely sources. And you find those sources on the Internet, and when I can help other people find them, it's not only in my personal interest but in a funny way my class interest. There are lots of people like me actually, if you go out and look around at the number of people who are earning their living in the U.S. just by sitting in front of their computer terminals all day. There's something like 12 million of us, and we are self-employed, we don't work for IBM or anything else. These people are not very group aware, but I think they're going to become that way. Especially more so as the old industrial structures of lifetime employment and so forth die out.

**Spender:** Information is the wealth generator of the future. It's as important to think about what we are setting up here as it was to think about the factory system that was set up in Britain last century. At the moment it's very clear that we are creating haves and have-nots on a grand scale. I think we have to see it as a form of insider trading, that people who know things are able to use it to gain wealth, and people who don't are going to be completely locked out of the discourse of society. A lot of Americans have said to me, by the year 2000 everybody will be connected. And I say, “14 million homeless”, and they say “Oh no, not them!”

**Wark:** One hears a lot – perhaps too much – about hackers who illegally use computer networks. But perhaps we have just as much to worry about from the authorities who police it.

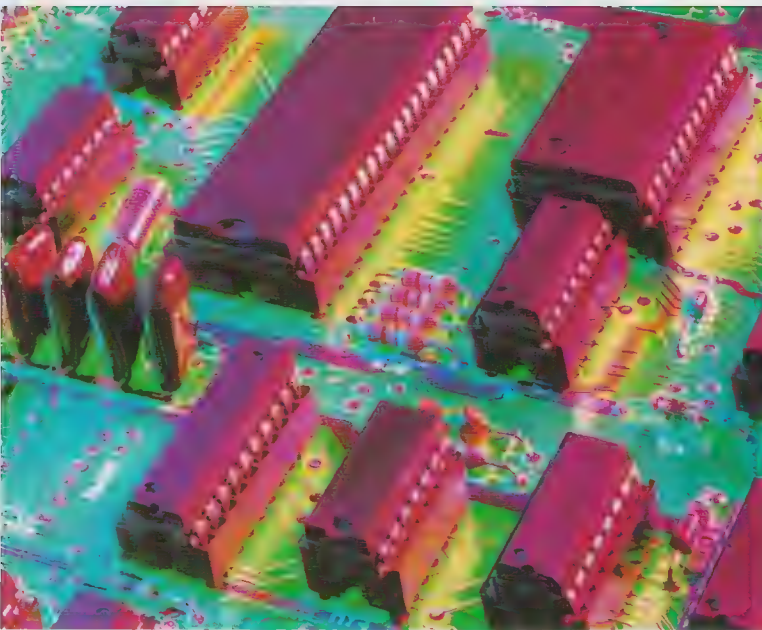
**Sterling:** The computer police up to now have been a bit quick on the draw, at least in the U.S. But you have to draw the line between what is possible and what has actually occurred. If you think about what could be done by acts of computer intrusion, the potential is truly frightening. There are possibilities for digital Chernobyls on a global scale.

**Wark:** On the other hand, the Internet has certain design features that make it rather difficult to centrally control.

**Barlow:** In the case of the Internet, who is the service provider? Who can you go to, to tap an Internet connection? The answer is, you can't, because when I send a packet out of my computer towards yours, it could go any one of a *ga-zillion* different ways to get there and it would probably take a different route than the next packet out. I think this technology definitely has politics – and they are anarchistic in nature. But, by the same token, life in the digital world makes it very easy for governments to monitor you, because every time you make any kind of financial transaction you smear your fingerprints all over cyberspace. If you fling out a wide enough net and go through a very massive search of digital data that's flowing around in the data cloud, you can start to assemble simulacra of people – in their commercial and personal dealings.

**Amy Bruckman:** The Internet is growing at a tremendous rate and this raises some interesting issues for how this space with so many people in it is going to be managed. Is it simply the person who controls the resources, controls the computer or controls the transmission medium controls the content? Or do people have certain rights?

**Wark:** The Internet is a wonderfully anarchic form of communication where a lot of the rules are made by consensus between parties who are



there. But sometimes it's hard to agree on what are acceptable ways of being on the Internet and what are not.

**Spender:** I've heard the word "netiquette" used again and again.

**Mathessen:** Since it's a written communication, it is simultaneously more distant and more intimate than face to face.

**Anna Couey:** How you get to know somebody is by what they say, and that cuts across a lot of social and economic barriers.

**Elizabeth Reid:** People who seem to be female on things like IRC and other network programs are often given a lot of attention, and that can be quite enjoyable for some people, for others it can create quite a problem. That comes into the realms of sexual harassment. The other thing is a lot of people get attention, or sometimes – just to find out what it's like to be on the other side – pretend to be a gender that they are not.

**Couey:** One of the things with harassment on-line is that it's more exacerbated in an on-line environment than in the physical environment. I'm not sure whether that has to do with the ratio of men to women on-line, but again I think it gets back to that disembodiment – because in a way you're freer to interact with people than you would on the street. People are not likely to walk up to you on the street and say "do you wanna talk dirty?" When they are on-line, the preliminaries are cut out.

**Wark:** So who gets access to this imperfect, but functional, communications anarchy?

**Geoff Huston:** Our future right now is that of a public information utility. Increasingly the asset of the network is the information resources that populate it, so in some ways we are a massive computerised information resource.

**Spender:** There certainly were haves and have-nots when it came to print, which is one reason we have state libraries. When it was recognised that not everybody could purchase books, the state had an obligation to provide people with that information. Maybe that's a role that libraries should take on in the electronic era, to provide 500 public computer terminals. We can talk about the fact that we are going to become consumers of white male Californian culture in a very short space of time.

**Wark:** But can the Internet ever be a mass medium? How many surfers really want to paddle into the digital sunset?

**Sterling:** It's absurd to think that everybody on the planet is going to want to do the sort of things that are done on the Internet. I mean, everybody on the planet probably does want to watch TV. Even people in Tibet like to watch Madonna – I don't understand why that is, but it's true. But I

don't think your average Yak herder with a satellite dish is really going to want to sit down and punch deck all day. There will likely be entertainment media that use some of the same packet-switching technology, but I think there is also likely to be a kind of international research and educational network that's used for scholastic activity and I think that's going to be the Internet. And I don't think that's going to be owned by Ted Turner [owner of Turner Broadcasting and CNN], or have a board of directors or president. I think the Internet will remain as a common good.

**Spender:** Some people have referred to print as the democratisation of reading; that up until books, only a few people in society could read. They generally did so from the pulpit and it was called reading the lesson for the week. Then suddenly there's print, there's books and everybody gets to learn to read. What we have to realise is that everybody is going to get the chance to become an author. In a way the computer heralds the democratisation of authorship and once everybody can do it, once there's no distinct individual effort; what does copyright mean anyway?

**Wark:** Or will the Internet perhaps have other uses?

**Robert David Steele:** My colonel, the director of the Marine Corps Intelligence Centre, and I, the senior civilian, spent US\$10 million on a classified - information handling system only to turn it on and find out that the CIA databases on the Third World were empty. At that point I went looking for, and discovered, open sources. What we are finding is that the various pipelines, the secrecy compartments, are counter-productive. The Internet is breaking down the barriers in the information continuum in the U.S. There is an iron curtain between each sector, there is a bamboo curtain between each institution, and there is a plastic curtain between each individual and sector. The Internet blows holes through those curtains. There are a number of people in universities, researchers and think tanks, businesses and newspapers who have absolutely first class information, and I include foreign governments. For instance, the Australian government have first class information about Papua New Guinea, a place where marines might have to go one day. It makes a lot of sense for us to exchange information with Australia – or indeed Papua New Guinea – about what we call encyclopedic intelligence; the ports, the airfields, basic unclassified stuff. It's in the strategic interest of every country to harness its information continuum, and the Internet is an absolutely vital element of that national strategy.

**Wark:** On a more mundane level, are the policies we have in Australia for the development of the Internet adequate?

**Huston:** Back in around 1987 or 1988 the need for a specialist data communications network was evident to the sector. We saw that our investment in computing was quite extensive, but when we looked overseas we saw that not only were similar investments being made, but they were being productively linked together with data networks. At that stage the U.S. APAR/Internet was well under way, providing amazing connectivity amongst the university and research community in the U.S. In Australia we spent some time trying to find if there was a publicly available facility that could provide similar functionality domestically, and link us with computing and communication projects going on overseas. We found that there was nothing in the public domain. After some soul searching the answer came through; that if we really wanted this facility, then as universities we had to work together and build it ourselves.

**Spender:** There's a slogan about us being a "clever country" and we'll export "intellectual resources," but it's made by people who have absolutely no idea and knowledge of the way in which the culture is changing.

**Huston:** Today AARNET connects some 105,000 computers in Australia in a population of 17.6 million. Contrast that to the current U.K. academic and research network, JANET, that links about 106,000 computers and Germany 110,000 computers, Japan 47,000. So in some respects we have been far more successful than other countries in terms of hooking vast numbers of individuals together. Over the last three years we have done astonishingly


well. The other kind of metric is how well we service this community, what bandwidth can we provide them that actually ships volumes of data around quickly and efficiently, and in that I don't think we are doing as well.

**Steele:** I had a long talk with Vince Cerf, president of the Internet Society, about this when we were out at an Internet conference in San Francisco a few months back. Vince is one of the fathers of the Internet through the ARPANET. And unfortunately they are so beholden to their original concept they are not willing to consider applications or content as new directions for Internet management. So right now the whole focus of the Internet Society and its magnificent working group is on increasing the size of the pipe. Unfortunately, all that really does is contribute to the amount of noise that can flow. One of the things I've been working on in support of the U.S. Vice-President's NII [information superhighway] is to put a content element into Al Gore's connectivity program. I mean right now, God bless him, Gore is all connectivity and no content. There is no national knowledge strategy in the U.S.

**Sterling:** Some people from the National Academy of Sciences [in the

U.S.] were telling me the other day that Al Gore, the American Vice-President, is a cyberpunk! I found that truly hilarious.

**Wark:** For some people the Internet is as much about spirit as it is politics.

**Barlow:** The Electronic Frontier Foundation was started because Mitch Kapor – who wrote Lotus 1.2.3 – and I realised that people were moving into this environment at a very rapid rate. Like all new frontier areas, the prevailing codes of ethics and laws and social interaction and property management were not worked out. The government was behaving as if all the rules that had worked perfectly well for the physical world were going to work for the virtual world. We wanted to see the government stay the hell out until something like a social contract had been developed. Most of the current inhabitants of the net are people who have very little awareness or interest in the type of hippy mysticism I bring to bear – it's mostly computer jocks at this point. It seems obvious to me that if you're in a place where there's no physical substance, where it's all immateriality, that you can't miss the relationship to that place that people have always been trying to go – which is composed entirely of spirit and mind. 'Cause that's what it's all about – now is the flesh become word. 

## Internet Jargon File

**AARNET:** The Australian Academic and Research Network, set up by the Australian Vice-Chancellor's Committee to oversee the Australian version of the internet.

**ARPANET:** The network set up by the Advanced Research Projects Agency of the American Department of Defence to allow high technology researchers in universities and aerospace industries to gain access to each other's computer resources. The Internet grew out of ARPANET.

**BOING BOING:** Very marginal, very cool magazine (or neurozine, as they would say) written for and by Californian netcruisers, available on the net.

**Bulletin Boards:** Or BBS for Bulletin Board Services, are small, local versions of the internet's global computer network technology. BBS usually run on ordinary personal computers and have only one or two phone lines through which users can connect to them. There are now dozens of these in every Australian city.

**Cyberpunk:** Marketing term applied to science fiction writings of William Gibson, Bruce Sterling, Pat Cadigan and others, but taken up by many Internet users as a description of a lifestyle or subculture to which they imagine they belong.

**Cyberspace:** Term popularised in a series of novels written by William Gibson, starting with *Neuromancer* in 1984. Although Gibson was computer illiterate, he created an imaginary future world that many Internet users feel is an enchanting description of what they experience on the Internet or expect it will develop toward.

**Electronic Frontier Foundation:** An advocacy group started by Mitch Kapor of the Lotus software company and John Perry Barlow. The EFF has a libertarian agenda, pursues free speech issues and monitors American government policy on computer networking.

**e-mail:** Short for electronic mail. It works like a post office box, where the post office is a big computer someplace that runs all the time and keeps messages for account holders, who can send and receive e-mail when they log on.

**Flaming:** The practice of writing abusive messages to others, especially ones that elicit abusive messages back. A unique social property of the Internet is that it can be very difficult to stop flame wars once they get started. Sure-fire flame topics include abortion, gun control and the war in Bosnia.

**FTP:** File Transfer Protocol, the most basic way of logging on to computers attached to the Internet other than one's



Illustration by Mark Newbound

own, so one can retrieve files from them.

**Gopher:** A more user-friendly method than FTP for finding files stored on computers linked to the Internet.

**Hacking:** A word that has shifted meaning, from any creative example of computer programming, to attempts to gain illegal access to networked computers.

**Information Superhighway:** Slogan popularised by American Vice-President Al Gore to explain the

'vision thing' he has about his government's National Information Infrastructure (NII) policy [see feature by Gore this issue]. The latter is mostly about creating a new, bigger market for information services, and a more efficient form of business communication. The Internet is regarded by some as an experiment that indicates to business that such a service, with a better interface, could be commercially viable.

**Interface:** The way you interact with the computer, and the way it interacts with you.

**IRC:** Stands for Internet Relay Chat. A means of communicating 'live' with several other participants who type messages to each other, which appear one after the other on the screen.

**MUD:** Multi-user dungeons or dimensions. These are places where one logs on, selects a character and hunts for monsters and treasure – all in a text only interface. There are now a number of different kinds of MUDs, MOOs and muses, based on different software environments, some of which are more about building interactive text environments or chatting with other 'characters' in such spaces.

**Netcruisers:** People who spend a lot of time on the net, and learn their way around so well that they can pass on information about navigating the net to others, either as a public service or for a fee.

**Netiquette:** The evolving codes of acceptable behaviour that users of the internet need to observe to avoid getting flamed.

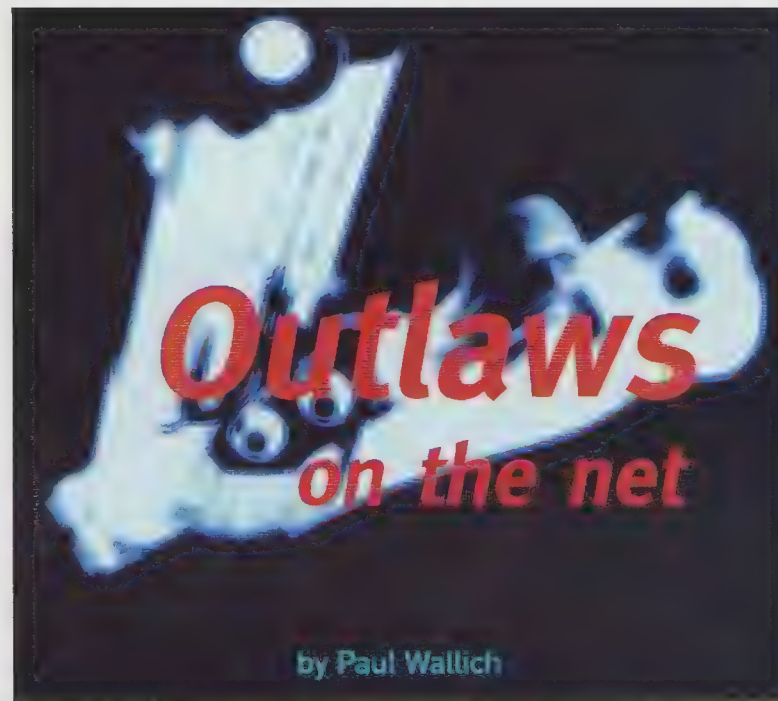
**Packet-Switching:** The software protocols that enable the Internet-linked computers to bunch data up into packets and despatch them to their final destination, via a chain of computers in between.

**Pegasus:** A non-academic, non-government provider of Internet access, based in Brisbane.

**UNIX:** The most common program run on computers that form the backbone of the Internet.

**Usenet news:** There are thousands of usenet newsgroups dedicated to anything from genetic research to fishing. They are publicly available messages that can be either monitored or unmonitored. Anyone can post in unmonitored newsgroups, but beware of getting flamed!

**The Well:** The Whole Earth 'electronic link'. A computer system based in California and run by the Point Foundation, the people who run the *Whole Earth Review* magazine.



The last legal frontier may be the lawless badlands of the Internet. In the 'net can anyone hear you scream libel?

It's become dangerous to speak your mind on the Internet.

People have always known that gossiping to a few thousand friends and acquaintances can get you in trouble. But in practice, even the most vicious ASCII enemies generally kept a firm separation between the 'net and real life. Lately, however, some folks have been taking their disputes out of cyberspace into the physical world.

What once provoked electronic "mailbombing" or "flaming" can now get people sued or fired.

In late 1993 a 'net denizen in Canada initiated a libel action against an English interlocutor who disparaged his academic credentials in an electronic forum. The plaintiff also sued several universities whose computer systems carried the offending messages. The universities settled out of court, but the individual action is still pending.

In February, the director of the U.S. National Agricultural Library sent out a lengthy retraction and apology after an employee spoke out on an Internet mailing list. The employee had questioned both the Food and Drug Administration's approval of genetically-engineered growth hormones (BST) for cows and the objectivity of industry-funded researchers. A government official also complained to Cornell University's vice president of research because Melinda Shore, a programmer at Cornell's supercomputer centre was participating in the discussion. Shore's economic objections to BST (which could ruin many small dairy farmers) apparently raised government hackles.

A few weeks later, Lockheed Space Operations Corp. clamped down on an engineer who had been posting information about shuttle launches to the Usenet newsgroup sci.space.shuttle from a NASA computer and from a private account elsewhere. (Lockheed spokesman J.B. Kump refused to quote the rule that was ostensibly violated, explaining that another, equally unquotable rule forbids release of corporate rules.) The muzzling triggered a flood of e-mail complaints to NASA – within four days the stack (single-spaced and printed on both sides of the page) was an inch thick. Meanwhile, at least four people, including an Australian, are posting much the same material.

Even purely personal discussions can have official repercussions. In March, a software glitch spewed private e-mail from a computer bulletin board (BBS) in Florida onto a Usenet newsgroup. The BBS operator, "HUNG+", whose explicit personal advertisement was one of the items posted,

was offended by the resulting complaints and by suggestions that his users take their business elsewhere. He began a campaign of telephone calls and faxes to senders' organizations. One lost access to the 'net and another was threatened with disciplinary action.

HUNG+ rapidly became a pariah, but the social controls that usually enforce Usenet's minimal conventions were ineffective – it doesn't do much good to have a quiet word with a network site's system administrator when the sysadmin is the problem.

In the old days, as Shore recalled, a note to "postmaster" could be followed by a note to a site's newsfeed (the next computer up the line in the chain of message distribution). Feeds were all arranged by friendship or professional courtesy, and a site that disregarded netiquette could find itself out in the cold. But now HUNG+ and thousands of other smaller network nodes buy their newsfeeds from information-highway entrepreneurs, and cash trumps custom.

In fact, adhering to the old spirit of the 'net can get a network entrepreneur in deep trouble. When a small-time law firm posted a questionable advertisement to more than 5,000 newsgroups on Usenet (blatantly disregarding prohibitions on irrelevant commercial messages), the sysadmin at indirect.com terminated the firm's account – upwards of 30,000 outraged e-mail messages may have helped sway his decision – and is now on the receiving end of a quarter-million-dollar lawsuit. Better yet, Canter and Siegel, the lawyers in question, have now purchased their very own Internet site to prevent any further muzzling of what they see as their right to reach everyone on the Internet, like it or not.

HUNG+, meanwhile, has reappeared on a different newsgroup, under a more savory name, offering get-rich-quick investment advice.

How will the 'net govern itself in a world where free speech rights are mere local ordinances and newcomers refuse to be bound by gentlemen's agreements they never made? Signs of strain are evident: many sysadmins have discussed simply discarding all messages from offending sites, be they HUNG+'s tiny BBS, or giant online services with hundreds of thousands of subscribers, such as America Online and Delphi.

It's just too much trouble to sort the good users from the bad, they say. Then again, it's good to remember the most oft-used headline in cyberspace: "Imminent Death of the Net Predicted, Film at 11."

This too may pass. ■



# Do Vice-Presidents dream of electric sheep?

by Al Gore

The Clinton Administration is starstruck with the Information Superhighway, a high speed Infobahn that will shake the very foundations of society. But it won't be an easy transition, explains Clinton's sidekick, the first VeePee with a cellular phone.

The historian Daniel Boorstin once wrote that for Americans "nothing has happened unless it is on television". This is fine I guess, but it does leave out a few major events in history.

Yet today Boorstin's comment is not that far from the reality. We've all become used to stumbling over clichés to describe the enormity of change underway in communications and the incredible speed with which it is taking place. What we've seen in the last decade is amazing, but it's nothing compared to what will happen in the decade ahead. The word "revolution" by no means overstates the case – if, for example, cars had advanced as rapidly as computer chips in the last few years, a Rolls Royce today would go a million miles an hour and cost 25 cents.

But this revolution is based on traditions that go far back in history. Since the transcontinental telegraph transmitted Abraham Lincoln's election victory to California in real time, the ability to communicate electronically has informed and shaped the world.

It was only a year before that election that the Pony Express was the talk of the nation, able to send a message cross-country in seven days. The next year, it was out of business. Today's technology has made possible a global community united by instantaneous information and analysis. Protesters at the Berlin Wall talked to the world live via CNN. The fax machine connected us with demonstrators in Tiananmen Square. So it's worth remembering that while we talk about this digital revolution as if it's about to happen, in many ways, it's already here. Even in the White House – the day after Inauguration, I was astonished to see how relatively primitive the White House communications system was. President Bill Clinton and I found operators actually having to pull cords for each call and plug them into jacks! And there were actually phones like these all over the White House. We've replaced them.

Our new ways of communicating will entertain as well as inform. More importantly, they will educate, promote democracy, and save lives. And in the process they will also create a lot of new jobs. They're already doing so.

The impact on business will not be just limited to those in the information business, either. Virtually every business will find it possible to use these new tools to become more competitive. When I was in Central Asia recently, the President of Kyrgyzstan told me his eight-year-old son came to him and said "Father, I have to learn English". "But why?" President Akayev asked. "Because, father, the computer speaks English."

## The Computer Crunch

We're familiar with how modern communications transcend national boundaries and bring our world closer together. But many communications technologies are in the process of transcending boundary lines which have long defined different sectors of the information industry.

The speed of boundary erosion is quite dramatic. I'm reminded of the British physicist Stephen Hawking who has Lou Gehrig's disease. Thanks to information technology he can still communicate, not only to his students and colleagues, but to millions around the world. I read the other day that his voice box has an American accent – because it was developed in California.



In that American accent, Hawking has speculated about a distant future when the universe stops expanding and begins to contract. Eventually, all matter comes colliding together in a “Big Crunch” which scientists say could then be followed by another “Big Bang” – a universe expanding outward once again.

Current information industries – cable, local telephone, long distance telephone, film, computers, and others – seem headed for a Big Crunch/Big Bang of their own. The space between these diverse functions is rapidly shrinking – between computers and televisions, for example, or interactive communications and video.

But after the next Big Bang, in the ensuing expansion of the information industry, the new marketplace will no longer be divided along current sectoral lines. There may not be cable companies or computer companies as such, everyone will be in the ‘bit’ business. The functions provided will define the marketplace. There will be information conduits, information providers, information appliances and information consumers.

That’s the future. It’s easy to see where we need to go, but it’s hard to see how to get there. When faced with the enormity and complexity of the transition, some retreat to the Yogi Berra view: “What we have here is an insurmountable opportunity.”

Not long ago this transition did seem too formidable to contemplate, but no longer. A remarkable consensus has emerged in business, public interest groups and the government, and this consensus begins with agreement on the right questions.

#### Politics on the Internet

How can Government ensure that what emerges on the other side of

**The nation needs private investment to complete the construction of the Superhighway. And competition is the single most critical means of encouraging that private investment.**

the Big Crunch will allow everyone to compete for the opportunity to provide any service to all willing customers? How can we ensure that this new marketplace reaches an entire nation? How can we ensure that it fulfills the enormous promise of education, economic growth and job creation? Legislative and regulatory action alone will not get us where we need to be. Government often performs best when it sets clear goals, acts as a catalyst for the teamwork required to achieve them, then lets the private and non-profit sectors move the ball downfield.

It was in this spirit that Bill Clinton and I campaigned for the White House in 1992, setting as a vital national goal the linking of every classroom in every school in the U.S. to the National Information Infrastructure, what I like to call the Information Superhighway. When it comes to telecommunications services, schools are the most impoverished institutions in society. But some communications companies are now talking about voluntarily linking every classroom to the Superhighway.

The Administration will soon introduce a legislative package that aggressively confronts the most pressing telecommunications issues, and is based on five principles. We will, firstly, encourage private investment; provide and protect competition; provide open access to the network; take action to avoid creating a society of information “Haves” and “Have Nots”; and encourage flexible and responsive governmental action. True to our goals, the White Paper on the Information Superhighway, outlining the bill in detail, is available on the Internet.

The nation needs private investment to complete the construction of the Superhighway. And competition is the single most critical means of encouraging that private investment.

#### Avoiding Road Kills on the Superhighway

The U.S. Congress funded Samuel Morse’s first demonstration of the telegraph in 1844. But when Morse suggested a national system be built with federal funding, Congress declined, saying private investment should build the information infrastructure. And that’s what happened – to great and continuing competitive advantage. For the Superhighway, we must choose competition again and protect it against both suffocating regulation but also from unfettered monopolies.

To understand why competition is so important, recall what has happened since the break up of American Telegraph & Telephone Co a decade ago. In 1987, AT&T was projecting that it would take until the year 2010 to convert 95 per cent of its long distance network to digital technology. When competition came along, AT&T made its network virtually 100 per cent digital by the end of 1992. Meanwhile, over the last decade, the price of interstate long distance service for the average residential customer has fallen over 50 per cent.

The next step is to open the local telephone exchanges, those wires and switches that link homes and offices, to the local telephone companies. The pressure of competition will be great – and it will drive continuing advances in technology, quality and cost. One businessman told me recently

that he was accelerating his investment in new technology to avoid ending up as “roadkill” on the Information Superhighway.

### The Recipe for Regulation

Preserving the free flow of information requires open access. How can you sell ideas, information or programs, if the intermediary – who is also a competitor – has the means to unfairly block your access to customers? We can’t subject the free flow of information to artificial constraints at the hands of either government regulators or would-be monopolists.

We must also guard against unreasonable technical obstacles. We’ve seen this problem in the past; when railroad tracks were different by one railroad to a town served by another. The use of standardised tracks permitted the creation of a national system of rail transport.

The future of non-commercial broadcasting must also be explored; there must be public access to the Superhighway. We must also have a regulatory approach that encourages investment, promotes competition and secures open access – not just a patchwork quilt of old approaches, but an approach necessary to promote fair competition in the future.

Equal treatment of competing entities should not blind us to the economic realities of the new information marketplace, where similarities may mask important differences. A start-up communications company is obviously not same as an existing telephone company such as a Baby Bell. What we favour is genuine regulatory symmetry – regulation must be based on the services that are offered and the ability to compete, and not on corporate identity, regulatory history or technological process.

### The “Haves” and “Have Nots”

In the information marketplace of the future, investment, competition and open access will be obtained only if regulation matches the marketplace. That requires a flexible, adaptable regulatory regime that encourages the widespread provision of broadband, interactive digital services.

Our proposals for symmetrical, and ultimately unified, regulation show how we will initiate government action that furthers our principles but adapts, and later disappears, as the need for governmental intervention changes – or ends. They demonstrate the private and public sectors working together to fulfil common goals.

The principles I have described will build an open and free information marketplace. They will lower prices, stimulate demand and expand access to the Superhighway.

They will, in other words, help to attain the basic principle of avoiding a society of information “Haves” separate from a society of information “Have Nots”.

### The E-mail Must Get Through

*The Washington Post* recently ran a headline which read: “Will the Information Superhighway Detour the Poor?”

Not if I have anything to do with it. After all, government action to ensure universal service has been part of American history.

What we have become is an information-rich society. Almost 100 per cent of households have radio and television, and about 94 per cent have telephone service. Three-quarters of households contain a VCR, about 60 per cent have cable TV, and roughly 30 per cent have personal computers.

As the information infrastructure expands in breadth and depth, so too will our understanding of the services that are deemed essential. This is not a matter of guaranteeing the right to play video games, it is a matter of guaranteeing access to essential services.

## We cannot tolerate - nor afford - a society in which some children become fully educated and others do not; in which some adults have access to and others do not

We cannot tolerate – nor afford – a society in which some children become fully educated and others do not; in which some adults have access to training and lifetime education, and others do not.

Nor can we permit geographic location to determine whether the Superhighway passes by your door. I’ve often spoken about my vision of a schoolchild in my hometown of Carthage, Tennessee being able to turn on her computer and plug into the U.S. Library of Congress. Carthage is a small town – its population is only about 2,000 – so let me emphasise the point: we must ensure that no geographic region of the United States, rural or urban, is left without access to broadband, interactive service.

All this won’t be easy. It is critically important that all carriers must be obliged to contribute, on an equitable and competitively neutral basis, to the preservation and advancement of universal service.

### Building a Technocracy

Reforming our communications laws is only one element of the Administration’s Superhighway agenda. Applications of the Superhighway will be promoted in areas such as scientific research, energy efficiency and advanced manufacturing. Government services must be delivered more efficiently. Policies must be updated to make sure that privacy and copyright are protected in the networked world. On the other hand, law enforcement agencies will need help to thwart criminals and terrorists who might use advanced telecommunications to commit crimes.

Our economic future will depend on the ability to grasp opportunity and turn it into concrete achievement. But as we do so, we must never lose sight of the heritage of innovation and entrepreneurship. It is easier to appreciate that heritage when we see countries without it, such as Russia, a country that tried to hold back the information age and at one time posted armed guards in front of photocopiers. This did nothing but kindle the desire of Russians to end Communism. My hope is that now Central and Eastern Europe can use technology and the free market to build democracy, not thwart it.

In her Nobel Prize acceptance speech, American novelist Toni Morrison quoted an old story, a parable really. It’s of a blind, old woman renowned for her wisdom, and a boy who decides to play a trick on her. He captures a bird, brings it to her cupped in his hands, and says, “Old woman is this bird alive or dead?” If she says “Dead,” he will set it free. If she says “Alive,” the boy will crush the bird. She thinks, and says, “The answer is in your hands.”

Toni Morrison’s point is that the future of language is in our hands. As we enter the new millennium, we are learning a new language. It will be the *lingua franca* of the new age. It is made up of ones and zeros and bits and bytes. But as we master it – as we bring the digital revolution into our homes and schools – we will be able to communicate ideas and information. In fact, entire Toni Morrison novels will be available on the Superhighway, with an ease never before thought possible. The future really is in our hands. ■



## The Hitchhiker's Guide to the Infobahn



by Phillip Adams

Who will provide the hitchhiker's guide to the information superhighway, the electronic Shangri-La which will take us to a wonderful future? Geoff Chester from Washington's Centre for Media Education and David Lytel, spokesperson for the White House Office of Technology, debate the issues with Phillip Adams.

Recently, Bill Gates – the almost mythical head of Microsoft, the world's biggest computer software firm headed by the world's wealthiest nerd – preached his plans for an information superhighway in Australia. Microsoft and Macro Cellular, makers of mobiles phones, announced they were to spend US\$9 billion in the hope of launching 840 satellites into space. Well, not quite into space; these are sort of low orbit satellites that just go over the roof, just over the Hills hoist.

What does this mean for us as consumers? Well, the idea is that these satellites would form a global wireless telecommunications network, providing an information superhighway that we can access in our homes and at work – enabling us to receive voice, text and video signals through one outlet, like the telly.

I'm old enough to remember the most astonishing claims for a succession of technologies. Each one of them was going to provide a new and vibrant form of democracy, each one of them was going to give us cultural riches beyond our wildest dreams: variations on Shangri-La. So I'm a little suspicious about the claims of the superhighway. And in fact it's admitted that there are barriers to be overcome and that this is a technologically driven push. There is no real evidence that consumers are demanding it – how can they when they don't understand it? Indeed

*The Wall Street Journal* recently dubbed talk about the superhighways as 'The Highway of Hype'.

In Washington recently about 500 people, representing public interest and consumer groups, including my old friend and colleague Ralph Nader, met with Vice-President Al Gore and officials from the Clinton administration to try and ensure that some of the promised community benefits of the information highway are delivered through strong public policy.

Two opposing American experts are Geoff Chester from the Centre for Media Education in Washington and David Lytel, spokesperson for the White House Office of Technology.

*I understand that when Al Gore was a senator he was a major critic of cable TV monopolies and in particular their overcharging. Is he still as critical of the current monopolies who are trying to get their stake in this information superhighway?*

**David Lytel:** Well, he is just as much anti-monopoly as he's ever been, and in fact among the key principles he's talked about is the need to promote competition. We all know competition between different service providers not only drives the cost down, but improves the quality of service. After all, there needs to be services that consumers are willing to pay

for and information appliances that they find easy to use. And it is competition rather than heavy handed regulation that will facilitate that.

*David Edward Marky, who is a Democrat from Massachusetts, chairs the House Telecommunication Sub-committee, and he describes the danger he perceives in the superhighway as a form of informational apartheid. I remember learning that there are poorer parts of Manhattan which are still not connected to cable because the consumers can't afford to pay for it.*

**Lytel:** Well one might say that it is because the consumers can't afford to pay for it. But one might also say that the politics of the local cable franchising process went on and became exceptionally corrupt in New York resulting in some significant scandals and highly publicised suicides. It is not simply a matter of cable being priced too high, it also arrived in New York years later than other places. You have to remember that in the '80s, and for most of the history of cable television, it's been provisioned as a monopoly vocal service through franchises.

*Will the administration have to try and equalise access for the new technology?*

**Lytel:** We are very much in on negotiations with the Telecom reform legislation that's being considered by Congress, trying not just to negotiate open access provisions in the future, but to be able to negotiate them for today's cable television service providers. The problem is not simply a matter of consumers being able to afford to get service, the other side

*homes could have access to the new superhighway technology?*

**Geoff Chester:** This is one of the most critical decisions our country, and many countries, including Australia, will have to consider in the next few years. Who will have access to this technology? How much will it cost? Who will it serve and who won't it serve? Will they be able to survey all our conversations? Will it democratise our society? Will it open up electoral process so it's not just big money financing a campaign and issues? Will it make the communication system more diverse? And finally will it ensure the continuance of public service non-commercial, programming information services?

Although the administration has a lot of positive proposals and elements in their campaign to re-write the 1934 U.S. Communications Act, in fact they are looking at this issue with one eye closed and fingers crossed. They have been heavily lobbied by the major U.S. telecommunications companies who have been saying to them, basically free us and the technology alone will answer all the problems. And the administration has not been doing a good job in ensuring that real concrete safeguards are established initially – and more importantly that there is a national debate. People in this country don't know what's about to happen to them, who will be served, who won't be served. You're absolutely right, already 8 per cent of U.S. households don't have a telephone at all, and if you look at low income citizens in the United States, either in the

## What we'll be revealing shortly is that the new superhighway systems being rolled out

of the problem is to make certain that there are also service providers; in essence that networks are designed in such a way that people can speak as well as listen. Opening up those cable networks which really are very tightly controlled companies, to voices that are either non-commercial, or meet rather small audiences. That's among the negotiating principles that we have when we face congress on Telecom reforms.

*I vividly recall giving evidence to a Senate inquiry in Australia 15 years ago when I argued the new technologies were going to democratise information and break down the control of the oligopolies. Well of course that hasn't happened, has it?*

**Lytel:** Certainly there is a lot of hype. One of the most unfortunate things, as you've identified, is this myth that somehow the technology has within it this ineluctable democratising force, and that as prudent public policy-makers we understand that there are some significant benefits to popularising the means for public communications. But it's no panacea.

*The potential is enormous but we've got to get it to deliver. Due to costs not even every home in America has a telephone – and that's the case even with laws passed to keep residential phone rates down, so let's use the telephone as a comparison for the moment. Couldn't it be decades before most*

inner cities or in rural areas, a whopping 18 per cent don't have access to telephones.

*It's certainly my point of view that we'd have much more faith in a Clinton White House on this issue than a Reagan or Bush White House.*

**Chester:** There is no question, but the fact of the matter is that the initial orientation, the principal riding force for the Clinton administration, is economic growth. That is the principal rationale for what they call their national information infrastructure initiative. And really what the principal should be is democratising our society, ensuring that everyone has access. Although they talk about economic growth, there is no guarantee that whatever profits are generated from these new services are really going to create new jobs. I mean the only jobs I think are going to come down the pipe, aside from a few software developers, are those people carrying the home shopping goods that will be delivered over the virtual electronic shopping mall. We need more than rhetoric, and what happened with cable when deregulatory forces convinced the policy makers just to let the market make all the decisions.

*But I understood that there had been a move by Congress and the Senate to progressively re-regulate aspects of cable simply because it wasn't going as well as it should have been and questions of equity and prudent policy were*

*indicating that they had to roll back from free marketing?*

**Lytel:** I think Geoff misrepresents what the goals are. It's not 1984, at the height of the Reagan administration, which in essence deregulated cable television and gave us the problems that forced congressional passage of the Cable Act of 1992. Back in 1984 I was a local elected official trying to represent the public interest in the negotiation of a cable franchise and I looked at the passage of the Cable Act in '84 and understood, as most local officials did, that it was an absolute disaster. That's by no means a model for what we are trying to do here. If the passage of the '92 Cable Act represents moving in an opposite direction – having been forced to re-regulate – it's because, in a non-competitive environment, that was among the only mechanisms available to guard the public interests. But I think everyone can agree that what we need here in the provision of multi-channel television is multiple providers. So if you don't like your service from one cable company, you buy that service from another or you buy it from a wireless service provider. You buy it from many different people. Heavy handed regulation is not in the future of what is going to bring us the new communications.

*For many years Australians have felt rather beleaguered by American cultural imperialism. It's an old fashioned phrase but it's a daunting experience to be on the receiving end, so I took some comfort from an Economist piece quoting both Rupert Murdoch and Ted Turner of CNN, who sent a chorus*

Communications Commission followed up and strengthened its rules, which it did. However, people don't know where these networks are being built. What we'll be revealing shortly is that the new superhighway systems being rolled out by the phone companies are deliberately by-passing the poor here in the U.S. There have been no real public hearings in communities, even though we met in Washington it was an administration – directed event and really not open to the public. What we need to have are policies, and the administration must do a better job in leading to ensure that these systems will be open to all providers, that there will be non-commercial civic spaces created within what will unfortunately just be an electronic shopping mall. The administration has some good proposals, but for the most part has not really been aggressively leading, there is not a real democratic vision that they are articulating sufficiently here.

*Would it be possible for a little country like Australia to put up traffic lights along the information superhighway? If there are aspects of this remarkable technology that we find a bit culturally threatening, is there any way of dealing with it? I remember Arthur C. Clarke saying you can't put tariff barriers to the stars when he was talking about satellite technology. Is there any way that a nation could ward off some of the aspects of this technology?*

**Lytel:** I'd say you're in a difficult position because you speak English and in that sense are a part of the worldwide market in English-language

**by the phone companies are deliberately by-passing the poor here in the U.S.**

*that the world's getting a bit over-excited by this digital deluge. Turner said that every single interactive TV experiment has failed, people don't want to interact, it's hard work, they just want to watch. I took some comfort in that, I must say. Do you think they're wrong?*

**Chester:** I think what they are referring to is where the cable and telephone industries are going, I mean they want it delivered. I think this is the real danger. I don't think the administration is really signalling the dangers efficiently, they want to create a 500 channel cable TV world that is closed to real competition, that's under the control of a handful of companies and is not truly interactive. It's one way down. It may allow you to click in and buy...

*Essentially an anti-democratic notion?*

**Chester:** That's it. Right now Murdoch is heavily involved, in the lead of U.S. companies aggressively and, unfortunately, successfully lobbying Congress to ensure that his company and other over-the-air broadcasting companies grab a piece of the action without any real public benefit. While the administration talks about open access, a number of things are missing. Firstly, we are missing a national debate in this country. I helped re-regulate cable for Ralph Nader in 1992 and part of our work here at the Centre for Media Education was to ensure that the Federal

cultural product which can be an advantage and a disadvantage. But I can cruise the Internet in Australia. I have been in Australian cyberspace, kind of bopping around seeing what's available. It's wrong to think that Australians are not already pioneering in this field.

*I don't want to eliminate that stuff, it's just that from bitter past experience, we do tend to be on the receiving end of an avalanche. The global village had an American address for us.*

**Lytel:** I can appreciate that, and the question then ought to be what can be done to make Australian cultural products more successful in their own native markets so that the production of Australian culture is successful in films, radio and television.

*Tell us about the Clipper Policy briefly?*

**Chester:** Unfortunately the Clinton administration is pushing a policy that would give it a key to every digital communications device in this country. The administration says, for national security reasons, and in order for them to fight organised crime, they need to have the basic code from digital communications. But what we are concerned about is a government that will use it to know what we are watching, what we are reading, what we are buying. It's too much power to give to any administration, even one that's as friendly as the Clinton administration. ■



# Accidental Guru

by Phillip Adams

Over the generations there have been a handful of science fiction writers so prescient that they didn't merely imagine a future, they helped bring it into being. One of them is William Gibson, whose *Neuromancer* series helped shape the emerging world of cyberspace. But for Gibson, the future is not all cyber-roses.



William Gibson's books are invaluable for any aspiring cyberspace aficionado – after all, he did coin the term. But it is not only SF buffs who have paid attention to the lord of cyberspace, for Gibson, without realising it, had come to describe a world already in the making. And telecommunications- and computer-technos around the world recognised his topography:

"There's no there, there. They taught that to children, explaining cyberspace. She remembered a smiling tutor's lecture in the arcology's executive crèche, images shifting on a screen; pilots in enormous helmets and clumsy looking gloves, the neuroelectronically primitive 'virtual world' technology linking them more effectively with their planes, pairs of miniature video terminals pumping them a computer-generated flood of combat data, the vibrotactile feedback gloves providing a touch world of studs and triggers... As the technology evolved, the helmets shrank,

the video terminals atrophied." (From *Neuromancer*)

Gibson's cyberspace was evolving even as he concocted his technofutures from his decidedly un-techno manual typewriter more than a decade ago. His hard-boiled *noir* style and feverish imagination gave catch-phrases to what McKenzie Wark has described as "a world created by the intersection of every jacked-in consciousness, every database and installation, every form of interconnected information circuitry... human or in-human."

Gibson's original cyberspace trilogy, *Neuromancer*, *Count Zero* and *Mona Lisa Overdrive* helped shape the lexicon of the Internet. His latest offering, *Virtual Light*, takes his vision of a crumbling world, where the best life is a virtual life, one step further. Phillip Adams interviewed Gibson on his recent trip to Australia.

It's certainly darker than what the Clinton administration is telling you about the information highway. I think that the highway metaphor is going to prove to be particularly inappropriate, because a highway is something you can go both ways on. It seems to me what they are proposing is just a big wideband version of the sort of media that I've grown up with in my lifetime, it's a very, very passive thing. The technology may exist to put this thing into effect, but where are they going to find the talent to fill 500 channels with anything?

*I've spent many years in Australia working on film industry matters, writing out cheques with government money, and you are dead right. Real talent is an illusive, rare and precious thing.* Well I'm sure we'll have the Ralph Lauren channel and the Calvin Klein channel and they'll run 24 hours and you can send for anything you want. One of my fantasies is that one of these channels would constantly switch through airport security systems around the

*the book the print cartridge if you will; you can fast forward them by riffling through the pages, you can freeze frame on a paragraph can't you?*

Well, with slightly more advanced technology, each of us will own several really lovely books made out of the best paper and they'd smell like books and have handsome binding, it's just that each time you opened it, it would be the book you wanted it to be.

*You are starting to seduce me here, I can feel my cynicism evaporating as you describe this volume. Would it be a first edition?*

Well, it could be whatever you want it to be. It would be a cross between a book and television, but you would never have to change the batteries. I mean, we are into fantasy-land here.

*Everything you say seems to come true, would the book read to me if my eyes were tired?*

Probably, and it would glow in the dark if you wanted to read by the pool at night. But one of my favourite Arthur C. Clarke statements is that any sufficiently advanced technology will

## I feel a certain professional requirement to be deeply ambivalent about

The really dangerous writers are the writers of science fiction. They've been causing trouble ever since H.G. Wells and his *War of the Worlds*, *The Invisible Man* and *The Time Machine* last century. Not content with being prescient about the future, they conjure it into being. Arthur C. Clarke doodles on the back of an envelope and suddenly we've got communication satellites bumper to bumper over our heads. L. Ron Hubbard gave us Scientology. And William Gibson has given us Cyberspace; the space where we communicate through electronic mail to another human or directly to a computer.

*You are being constantly called a guru by cyberpunks, placing a burden on you which I know you find a bit onerous.*

Well, actually, I'm quite happy with Cyberspace. It's Cyberpunk that I have problems with. Cyberspace at least is of my own coining. Cyberpunk began as a sort of journalistic label and it was snappy and caught on.

*Your fictional cyberspace is a rather dark one, is it not?*

world and show you X-rays of people's luggage.

*I don't think I'd mind looking at that for a while – I try to peak whenever I'm at an airport.* Well it would have a certain hypnotic charm, but in Los Angeles there are 70 channels on most people's cable, and there is really nothing on it [to watch].

*Do you still like books, things of paper and print?*

Very, very much so, although I also like trees. I was at an architectural conference in California a few years ago and a young European architect gave an impassioned description of this marvellous, highly computerised library that he had proposed building in Paris, and they had turned him down. He hadn't won the competition, but I was very impressed with his proposal. And I turned to the young woman who happened to be sitting beside me and I said, "Gosh what a great building", and she looked at me with the absolute contempt of an old fogey, and said a library is something on the end of a modem.

*I like to think you have an option. Let's call*

seem like magic to the people who don't have it. I'm actually not a big believer in science fiction's predictive capacity; I actually don't find it has a terrific record along those lines.

*It doesn't stop you from playing with it though, does it?*

No, but I try to learn from the mistakes of the past as far as science fiction goes, and consequently, I don't take my own predictions very seriously at all. For instance, in *Virtual Light* I was extremely proud that I had presented a world in which from the internal evidence of a book, you can't tell whether or not the United States exists as a political entity. But there lurking in the background was the Soviet Union, and lo and behold a decade down the road it's gone. And I was just utterly incapable of imagining that anything that stodgy and monolithic and slag-like could disappear.

*Well, join the crowd William – so was almost every political pundit on Earth. Something that often does survive though is the moral within the parable. Now I can still vividly remember a dozen or so Ray Bradbury stories from 40 years*

*ago, and while he got the technology wrong, he raised the right issues.*

Yes, that's quite true, and in that he differed from any number of his contemporaries.

*However, I interviewed him last year and to my horror, he was a George Bush voter. I was heartbroken.*

Well, he's a deeply conservative man, at least that's my understanding, I don't know him personally. But that's quite a tendency in the previous generations of American science fiction writers, they've tended to be fairly – some of them extremely – right wing.

*I don't think you are, are you?*

No, I'm sort of somewhere vaguely left of centre, I think.

*Do you surf the Internet?*

Not at all. I don't have an e-mail address and I suppose I actually suffer from some sort of cyber-phobia, you know, the fear that I'd be pressed to death by incoming e-mail if I hung out my shingle.

*wonder whether any nation is going to be able to hold itself together as people go surfing on the Internet and running around the information superhighway. Won't it be hard for any sense of national identity to survive? I'm not necessarily saying that the end of nation wouldn't be a bad thing, but I'm curious about this.*

Well, I think that what we're looking at with this technology is something that almost amounts to the end of geography. The geography will still be there quite literally and physically, but the distances won't matter. The concept of an English language media block will become meaningless the day the first intelligent on-line translation services come into being. And those are on the drawing board somewhere. So the kids in Hong Kong, or even better Singapore, would be able to talk to kids in San Francisco and Moscow. It won't matter which language they're using.

*I think you should confess that you are in fact talking to me in Swahili but being instantly translated in real time, aren't you?*

media barrage from outside.

*That's the other side of the coin I guess, but it didn't happen.*

No, we don't really have – what was George Bush's unfortunate phrase – we don't have the New World Order in place to make it happen.

*You sound pessimistic, but you laugh about pessimism.*

I feel a certain professional requirement to be deeply ambivalent about all of this stuff, I mean I have to simultaneously be a writer and a technophile. There's really no other way for me to go up against the challenge of my job. Because technology by and large is quite neutral until you do something with it, until it comes to the specific application. If you can drive Freeman Dyson-style starships [powered by] nuclear bombs, then it won't do anyone harm because you're exploding them way out in the depths of space racing along.

*But every information superhighway notion also means that crazed Christian Fundamental-*

## all of this stuff, I have to be simultaneously a writer and a technophile.

*So the cyberspace you have is really between your ears?*

Pretty much so. I think what I do really, rather than try to predict the future, is I try to get to a sort of hypothetical future that allows me to look back at today's present from a slightly different angle. And in order to do that, the cyberspace I need is watching a lot of CNN and a certain mood, and just sort of letting the world's media flow over me and seeing what sticks.

*You were talking about the way Virtual Light doesn't really tell the reader whether the U.S. has survived as a political entity. Now something that greatly concerns me at the moment is I'm currently involved on a political committee and our job is to think about how Australia should celebrate the centenary of federation which comes up in 2001. When we celebrated the first federation in 1901, the media that tied Australia together, in a fragile way, was the telegraph wire, which gave us some sense of identity. And it was actually used in celebrations for that purpose. If by 2001 we have 500 TV channels, I start to*

Yes indeed.

*I can see what you're getting at; the physical world exists but we are then linked by common interest, instant electronic connections.*

Something I try, in a stumbling sort of way, to work out in the sort of fiction I write is what that's going to mean. There seems to be a tendency in the world over the last decade for everything to Balkanise under this over-arching umbrella of instantaneous communication. It's very nice to think of people being empowered – and being empowered very democratically – by this technology, but if you are crouching in a basement being shelled by the ethnic separatists, it really isn't going to help you very much to have a fax machine and a modem.

*And, of course, ethnic separatism is facilitated by the new technologies in that everyone can have their own channel or three.*

I think so, although I was quite taken by Alvin Toffler's suggestion in his most recent book that the whole hideous thing that has happened in the wake of Yugoslavia might have been prevented by a very carefully orchestrated

*alists can go fund raising too, doesn't it?*

Oh absolutely. It's really the difference between trying to create a commons and trying to create a shopping mall, and I think in the Internet you have the common, and in the information superhighway – as it's being presented to us – you really have a shopping mall. And a shopping mall is not a public space, it's a machine to milk your money. Every square inch of it is designed to take your money and, what we need, both in our cities and in cyberspace, is public space. We need a polis. ■

# Satellite



# Scavengers

by William Gibson

**U2 have blasted apart the barriers between performance art, high technology and the traditional rock concert with their recent Zoo TV tour. Yet, speak to the band and you get the feeling the revolution has only just begun.**

The graffiti covering the walls around U2's Windmill Lane studio spreads out in a single polychrome shout, all those spray-can voices lifted in a bright soup of language, spilling over into the surrounding neighbourhood of blank-faced warehouses. The wall becomes a street, the street its own district of praise, desire, apprehension: messages to the band. Prayers. Home towns. Names of the beloved.

Windmill Lane remains the perceived locus of the U2 phenomenon, though the band no longer record here. It is now their video centre, world headquarters of Zoo TV. The walls are still a station of the cross of late-20th-Century pop, but, as guitarist Edge points out, the kids who once scaled them are now more inclined to hoist a mini-cam over the walls and suck in a few seconds of souvenir footage to mark the completion of their pilgrimage. "It's better than looking," he muses. "They *have* it then. Experience can be rewound."

I've come to this place to participate in the U2-Zoo TV broadcast called the Triplecast. It's another notch in the band's radically self-conscious evolution-via-deconstruction in the '90s, booting their fame in the rock arena up into ongoing epic explorations of art *and* commerce. And though they approach technology like futurists, they haven't abandoned the past.

Inside Zoo TV headquarters, a retrofit: ancient freestone masonry, painted white, studded with Italo-halogen fixtures. The vibe here is something like an upscale private art college. Everything is extremely casual but somehow quite efficient. We are ushered upstairs to a small dark room where big twin TV monitors pulse a painfully pure light to the beat of "Daddy's Gonna Pay for Your Crashed Car". Lead singer Bono and Edge sprawl and perch, respectively, on a long couch.

Edge is turned out in high hippie-gypsy, his jeans leather-patched from 15 kinds of scrap. Bono wears a black cartoony suit and the big black Bono glasses. He apologises for the shades, pleading recent light-sensitivity. These pulses of light are being prepared for an Australian tour, he explains: footage of high-yield neon sources flaring in the dark. These are *almost* enough on their own, he tells the resident video techs, who are demonstrating other bits on subsidiary monitors: a bouncing slo-mo lemon, fragments of the lyrics in big san-serif capitals. We watch the lemon bounce. There's a discussion of the typeface. It isn't there yet. No. Not quite. The video techs are sent back to the digital drawing board, the better to pre-envision it all in cyberspace.

U2 are nothing if not meticulous. The trick, of course, is to build a certain

potential for randomness into all this, a *randomness* bent on coping with the balls-out, post-modern *weirdness* of the very world they're so intent on addressing. Not an easy order. I've already spent the afternoon taping readings for the Triplecast. I can't quite grasp what it's supposed to be exactly, but the Zoo mechanism is obviously on yet another roll. We follow Bono and Edge upstairs to a sort of kitchen to talk about the big picture.

**Gibson:** So what is the Triplecast all about?

**Edge:** We've got our hands on the airwaves – three channels broadcasting simultaneously. We're going to try to present the viewer with a series of choices as they watch any of the three channels, which will all start to change into one another as they go along, so they'll kind of blend and switch around. Say you're watching a concert and Bono takes off his sunglasses and puts them down in the middle of the show; you zoom out and suddenly we're in the middle of a large studio and we're selling the glasses. And if you want to follow the concert, you'll be going from one channel to the next and back again.

**Bono:** We can tell the story of Zoo TV, and at the same time completely demystify it – here's the dressing room, here's the fridge these guys take on the road. Maybe we'll have a closing-down sale for Zoo TV. We'd sell everything – the steel, the cars, the clothes. Everything must go. It's so awful, so *not* politically correct. We might be appalled by the idea next week, but what's interesting is that everything is up for grabs. U2 is so elastic at this point. We're trying to push out the parameters so that there are more choices for us as a group. It's quite a selfish thing we're doing.

**Edge:** I'm very interested in what technology is doing to all of us. It's like that ad for literacy of a little kid walking behind a car, and the car goes faster and the kid has to walk faster, and by the end he's running full steam as the car slowly leaves him behind.

**Bono:** I heard a good one from Allen Ginsberg last week: "Remember the future."

**Gibson:** Some people figure it's *over*, it's just *done* – an exhausted category. "The future" has become a historical phenomenon. Or science fiction has, anyhow. I've always said I wasn't writing about the future. The real challenge for me now would probably be this: to write the kind of novel I've always written and have it do all those same things, but set in 1994.

**Edge:** What do you think about this ownership-of-information issue, Bill?

**Gibson:** Well, that's always a knotty question for those of us who make our livings largely by maintaining that we do in fact "own" information.

I suspect that we're evolving new strategies. Bruce Sterling recently posted his non-fiction book *The Hacker Crackdown* on the Internet, with a special introduction outlining the specific uses for which he was making it available. Saying basically, "You may download this, you may copy it to disc, even make hard copy – but no fucking way may you print your own edition and sell it, because that's *my* gig." And I thought that was a very with-it thing for him to have done, particularly considering the nature of the content.

**Edge:** I think this is very interesting, the idea that there's real interaction, real communication, a revolution in the written word again. This is not just a case of picking up the phone; you've actually got to sit down and write something.

**Gibson:** Yeah, and if you can *write*, you can kick butt on the 'net. It's great for lonely kids who know how to write.

**Bono:** I remember early on in the days of computers feeling very excluded because of the language, all the buzzwords and jargon. The fact that it could all be reduced to a simple binary code didn't dawn on me until years later. So I reject that side. The punk that's still left in me just goes "Fuck off and die". But wherever it makes connections, then I'm interested. I feel that music is of the spirit and the only thing that interests me is where it connects with human relationships, because if technology doesn't serve that, it serves nothing. It becomes the equivalent of jazz/rock fusion, a kind of wank, a language that excludes others. And one of the most significant moments ever is on the way, which is when language dissolves. For any writer, for any poet, for any student of the Old Testament – what a moment that is! Think of the Tower of Babel: You can make it as a myth or a fact that people began to speak in different tongues, but this moment is coming full circle through technology. We are around the corner from the moment in time when you can speak to anybody from any culture and they will understand everything you are saying because it will be translated for them.

**Edge:** There's already systems that do that.

**Gibson:** They don't quite do it, but you can do some very interesting things with those systems. I once had the first page of *Neuromancer* automatically translated back out of a half dozen languages. It was very funny.

**Bono:** Yeah, we had a great thing happen in a small and rather powerful nation in the corner of the globe. They printed out the lyrics: "Monday morning, 18 years of dawning/I said howling" as "Monday morning, knitting years of gold" – which is much better! And I just recently

got an enquiry from a similar location about the duet I did with "Frank Sonata" titled "I've got you under my chicken." They were enquiring who wrote that, and my first thought was "I wish it were me!" From my point of view – from the point of view of the primitive – I see technology as liberating for very different reasons. The first printed circuit, as far as we're concerned was the fuzz box. Until that moment, if you think about it, the guitar was quite a cheesy instrument – then suddenly there's this roar. And whenever we experience that roar – whether it's in Gibson's books or Nam June Paik's video sculptures – that's what makes ideas more than just ideas.

**Gibson:** Where else do you hear that roar?

**Bono:** In Jenny Holzer's neon texts: "Ambition bites the nails off success" was an inspiration. TV war – those infrared pictures of the Gulf. Cruise missiles on Main Street. People with their shopping bags walking under tank barrels in Moscow. The everyday surrealism that is the '90s. For a long time now images helped decide the outcome of a war. It's not enough to win; you have to look good winning too. That's why there were bounties on the heads of journalists in Yugoslavia.

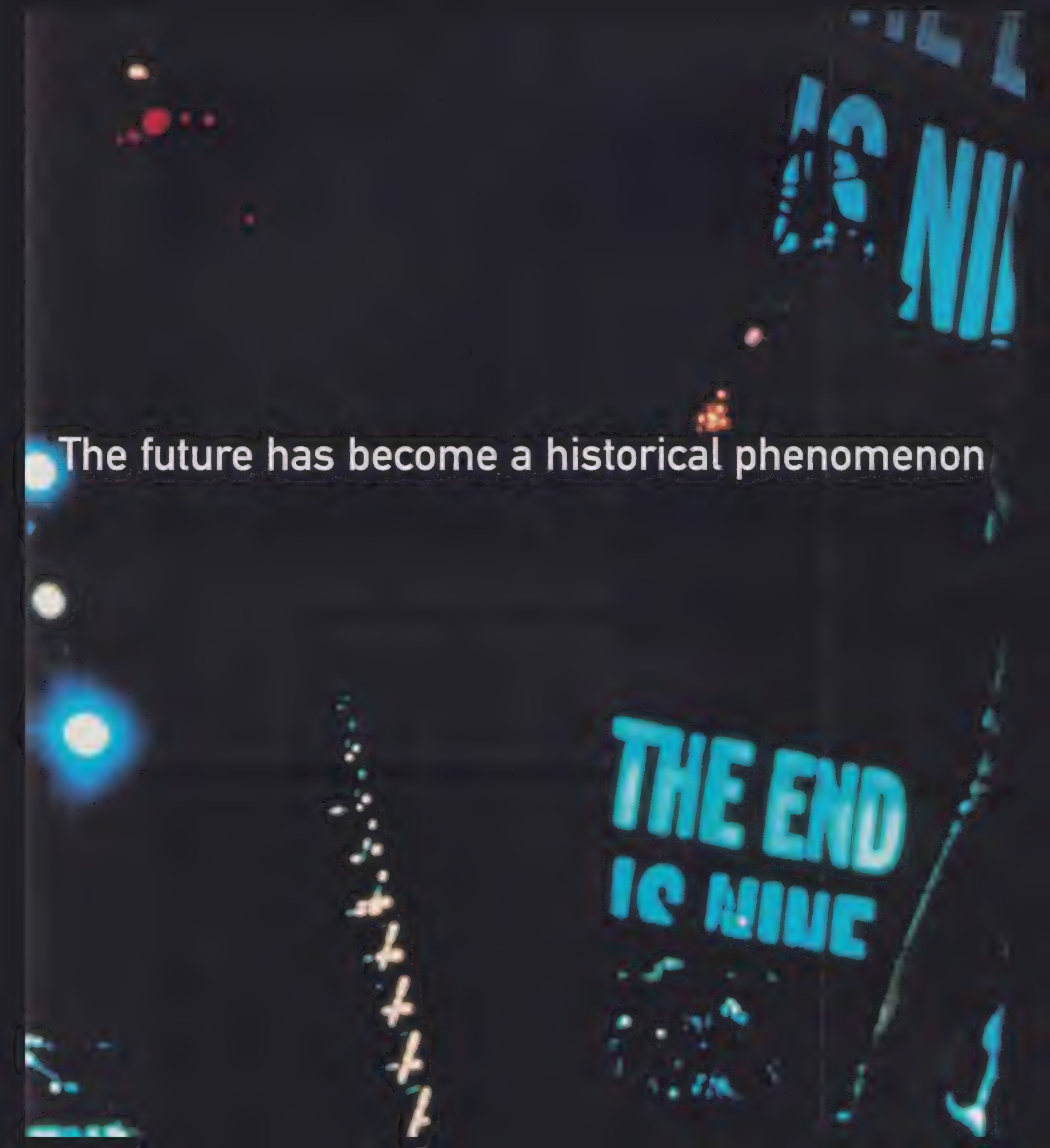
**Gibson:** The guys that designed samplers didn't have a clue what it would be used for on the street.

**Edge:** What's weird at the moment is there's so much new hardware out and we're like anyone else looking around and wondering to ourselves what we can do with it.

**Gibson:** My worry with the information superhighway...

**Bono:** ... which *is* the Yellow Brick Road.

**We are around the corner  
from the moment in time  
when you can speak to  
anybody from any culture  
and they will understand  
everything you are saying**



The future has become a historical phenomenon



## People stick on arms, an extra leg; it's sort of a Robo-Bono thing

**Gibson:** ... is that when it comes about, what we're going to get is 250 shopping channels, like the Ralph Lauren channel...

**Bono:** We don't have to be homogenised in Europe. You could continue to speak French and be completely understood on the other side of the planet.

**Gibson:** Yeah and computer translation will be a hoot. You could have student uprisings in Paris – while the ringleaders are Vietnamese kids in Tokyo. But that's the upside. The downside is people in India getting their traditional culture squashed by the local MTV feed. I'd sure hate to see all those amazing differences go.

**Edge:** This is a big issue in Europe. The backlash against a meaningful united Europe is astonishing to everyone. Obviously Yugoslavia is the most extreme example, but Germany and Italy – that's serious shit.

**Bono:** We went to an anti-Nazi conference in Hamburg and there were survivors from Auschwitz there, Günter Grass was there, all kinds of concerned German people – a whole pile of people from all around the world turned

up. And here we were thinking "What do we have to offer here?" And the line that I had in my head was "Humour is the evidence of freedom". In doing Zoo TV we stumbled upon the same thing that the Berlin Dadaists discovered, which is the idea of undermining the machismo of fascism: people underestimated its sex appeal and our duty was to kind of dampen their hard-on with the cold water of humour. Fear of the devil leads to devil worship, but if you mock the devil, he'll run. So let's get your demons out there and see what they are.

**Gibson:** Part of what you do is like rock 'n' roll *glasnost*. You've adopted this deliberate policy of openness.

**Bono:** We've got this media bonfire going, the fireworks are lighting up our sky, and (sarcastically) we're just exploding the clichés whilst warming our hands on them. It's different when lightning is your business.

**Edge:** There's myth and mystery and they are two completely different things. Although it's part of being a big group, I don't particularly like myth but to me mystery is everything.

**Bono:** At first when you're reading stories about your life in the media – who you're supposedly sleeping with, how much money you're supposed to be making, what you had for breakfast – you feel violated. Then you start to realise that the person they're describing has very little to do with you, and is in fact much more interesting than you are. The whole assemble-your-own-pop-stars idea is quite interesting and fits with our pop-star kit at the moment. Your public image is interactive – people stick on arms, an extra leg; it's sort of a Robo-Bono thing.

**Gibson:** This prefigures the truly digital pop figure, of course, who won't exist in any literal way. We already see that in quite a pure form in the *idoru* scene in Japan, these "idol singers" who are constructed from one girl's looks, another girl's voice, and a PR team to handle moments like these.

**Edge:** For a while we thought we knew what we wanted to be, and now we don't, so we're using Zoo TV as a way to...

**Bono:** ...celebrate uncertainty. 



Triple **R** Diversity in the Face of Adversity

102.7 FM  
THREE  
TRIPLE  
**RRR**

by Steve Mirsky

As humans encroach deeper into virgin rainforests,

they are coming across

strange viral strains which could unleash lethal plagues worldwide. Some of these

# BURNING CHROMOSOMES

viruses are already here, and they make HIV look like a picnic.

The Aztecs had successfully driven Cortez and the remnants of his routed invasion force out of the city of Tenochtitlan. The 400 Spaniards fled to a large open plain where “by all rights, they should have been pursued the next day and had their hearts cut out on top of the temple in the centre of the city,” according to historian William McNeill of the University of Chicago. But that did not happen. As the Spaniards waited in the field that night in 1520, a tiny bundle of proteins and nucleic acids they had unknowingly brought with them infiltrated Tenochtitlan. A plague fell upon the city, and when even the nephew of Montezuma died, the Aztecs, with no immunological experience at dealing with smallpox virus, simply surrendered.

Nearly five centuries later, we are the Aztecs. The new threat is coming from the forests and jungles in the form of so-called “emerging viruses” – viruses new to humanity and for which we have no resistance. The most familiar of these nightmarish bugs is HIV, the Human Immunodeficiency Virus which causes AIDS. These emerging viruses, however, threaten to make HIV look positively benign.



Computer generated image of the AIDS virus.  
Photo Library



We're going to be so unprepared  
the day one of them lands on  
our shores and takes off that  
I can't imagine the kind of  
panic it's going to produce  
in this society

Viruses are strange beasts. They are not, strictly speaking, alive. Nothing more than a few strings of amino acids and a pinch of DNA or RNA, viruses sneak into a living cell and change its programming: the cell is fooled into reading viral genetic commands and following them slavishly. It manufactures the viral proteins, and churns out new virus particles. "The very essence of the virus," writes Nobel Laureate Joshua Lederberg, "is its fundamental entanglement with the genetic and metabolic machinery of the host". In the virus' quest to reproduce and spread to other hosts, it may create conditions we recognise as the symptoms of disease. A simple sneeze may do for a less hostile virus. One called Ebola, however, turns the human body into what writer Richard Preston called "an oozing, melting mass of virus".

Where do new viruses come from? Some conspiracy fans think evil scientists designed HIV, for example, and let it loose on the world. The reality is that scientists aren't that bright. "There is no-one, inside or outside of government, however brilliant they might be, who could have conceived of making something like the AIDS virus," says Dr Stephen Morse, a virologist at Rockefeller University in New York City. "It's absolutely beyond the capabilities of a human being to have done this, quite honestly."

Morse coined the term "emerging viruses" and organised the first symposium on the subject in Washington in 1989. According to Morse, new viruses can appear in three ways, none of which requires the conspiratorial intricacies of an Oliver Stone screenplay.

When talking about viruses, especially those that cause disease, "new" usually means new to humans. The creation of truly new viruses involves genetic mutation of existing viruses. Although such mutation followed by natural selection – the mechanism of evolution – is important in the long run, we usually come face to face with new viruses for two other reasons. Emerging viruses are most often "existing viruses conquering new territory", Morse explains. A virus can suddenly spread from a small, isolated pool of humans to the larger population, such as when the small band of Spaniards shared smallpox with their unwilling Aztec hosts.

Viruses long carried by animals, notably rodents and mosquitoes, can emerge by making the jump to humans. "In such cases," Morse says, "introduction of viruses into the human population is often the result of human activities, such as agriculture, that cause changes in natural environments. Often, these changes place humans in contact with previously inaccessible viruses."

Yellow fever is a classic example of a viral disease spread by human

Species jump: The hanta virus spreading from rodents to humans may be the cause of kidney disease among inner-city residents in Baltimore.



activity, a case of evil begetting evil. In Africa, the responsible virus would cycle between the mosquito species *Aedes aegypti* and monkeys. A few hundred years ago, some *aegypti* laid eggs in what they took to be their usual breeding ground, tree holes. These were, however, water barrels on slave ships heading for the Americas. The mosquitoes thrived in the New World, the virus jumped to humans, and a new cycle of disease and death began.

The current global AIDS epidemic is likely the result of a combination of HIV first jumping among animal and insect species through to humans and eventually worming its way out of a small region of Africa to the world at large. An even more recent example of a species jump is the move by a group of related viruses from Korea called *Hanta virus*, whose usual hosts are rodents. The hantaviruses spread when people and rodents came together during rice harvests. Hanta also spread among rodent species, found its way to rats, which took it over the Pacific to the American Southwest, with devastating impact last year: 72 cases identified in humans so far, more than half of them fatal. A recent survey showed that a similar virus was present in about 80 per cent of all adult rats in Baltimore.

Although no specific fatal illness was associated with that virus, researchers conjecture that exposure through rats may account in part for high levels of kidney disease among inner-city residents.

No-one has identified the animal species where Ebola spends most of its time. When Ebola hits humans, however, the result is haemorrhagic fever, producing what Preston calls "biological meltdown". In 1976, Ebola suddenly appeared in Zaire, 277 people fell victim to the high fever and combination of simultaneous blood-clotting and haemorrhaging caused by the virus. Twenty survived. Ebola's fatality rate is thus about twice that for bubonic plague, before the advent of antibiotics.

Karl Johnson was a member of an international team of researchers who went to Zaire in 1976, saw Ebola's effects, and "spent three weeks collectively holding its breath". Considering that 13 of the 17 local healthcare workers had been killed, their fear is understandable. "I was shit scared," Johnson says. But the fear extended beyond personal concern. "A real question was: Had we finally run into the Andromeda Strain, like the deadly virus in the [Michael Crichton] novel?"

And in an era where any place on Earth is only a day or two away from anywhere else, there is the chance that Ebola, or some other horror, could jump suddenly to a far corner of the world. "We're going to be so unpre-

pared the day one of them lands on our shores and takes off that I can't imagine the kind of panic it's going to produce in this society," Johnson recently said in a television interview.

Ebola is one of the *filoviruses*, which translates to "thread viruses", their appearance under the electron microscope. Filoviruses are the nuclear weapons of the microbial world. The first filovirus was discovered in 1967 when laboratory workers in Marburg, Germany, began to get sick after handling a shipment of African green monkeys imported from Uganda to be used for medical experimentation. The first outbreak of Marburg hit 25 people and killed 7 of them. In 1989, macaques from the Philippines shipped to a facility in Reston, Virginia, not far from Washington, started to die from a haemorrhagic fever. Analysis showed the monkeys were infected with Ebola. When a lab worker exhibited flu-like symptoms, a small group of U.S. Army infectious disease specialists again held their breaths. This strain of Ebola, however, differed from the one in the 1976 outbreak. Although indistinguishable under the microscope, the Reston strain did not cause illness in humans – the lab worker had good old-fashioned flu. A few minor genetic variations, however, and the whole of Reston might have been covered in plastic.

Suppose, however, that an Ebola-like virus makes it to a large city and infects a person who happens to be an intravenous drug user. He shares a needle prior to the development of any symptoms. Those he shares the needle with go on their way and interact with their contacts before symptoms develop. "What would happen is you would wipe out a lot of people," Morse says.

Or suppose that an engineer from Chicago goes to Nigeria to attend his mother's funeral and gets feverish upon his return. Chicago doctors initially assume flu and haemorrhoids to explain his rectal bleeding. Finally, one doctor realises the man has just returned from Africa and calls the Centres for Disease Control in Atlanta, America's medical early warning system, to report the symptoms. They realise he has Lassa fever, another haemorrhagic fever disease, which also killed his mother, and then his father, brother, and several cousins following the funeral. He soon joins them. Lassa is spread from person to person by rats, so the engineer's quick hospitalisation and quarantine stopped the disease from spreading in the Chicago area. This case actually happened in 1989. Throw in a new rodent host and delay hospitalisation, however, and it may not have ended so swiftly. "We've been lucky," Morse says. "There's no question about that."

As we continue to expand deeper into the jungles and other untouched


natural environments, our luck will be sorely tested. For example, the continued encroachment into sparsely populated rainforest and conversion of it to farmland will bring ever-increasing numbers of people into first contact with unknown viruses or their animal hosts. "These are areas that have had their own ecology going on for ages," Morse explains. "It's a gamble. There's a chance that there may well be something that no human being has seen before that does have some potential to cause infection and do something nasty. It's like getting the three oranges on the slot machine. Every so often you'll get the one lucky combination – lucky for the virus, but unlucky for us. We have no way of predicting that."

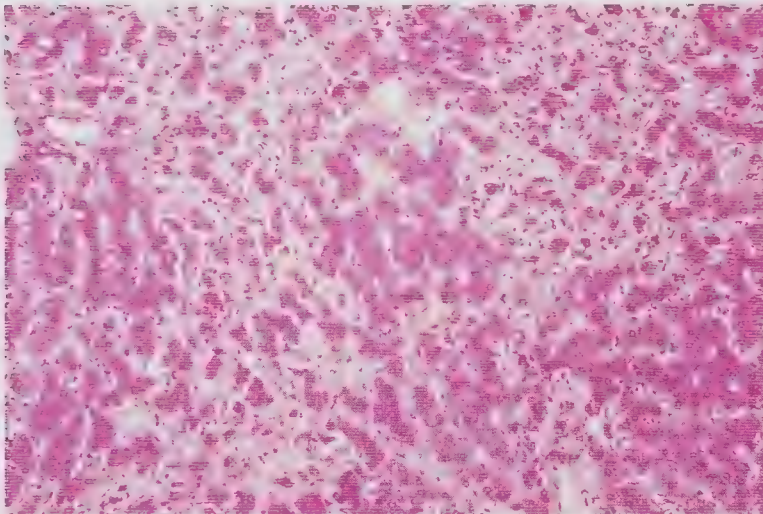
The displacement of people to large cities may also bring new viruses to regions of ever-increasing population density. As hundreds of thousands of Rwandans escape their shattered country, one must wonder if any uncatalogued viral threats are hitching a ride that will eventually bring them to a modern day Tenochtitlan – to New York, Sydney or Paris. Since we cannot predict the appearance of new viruses, how can we protect ourselves from the thousand natural shocks our flesh may soon be heir to?

"Surveillance," Morse says. "An early warning system is our best defence." Sending search teams out to identify new viruses, however, is probably not the way to go. HIV, for example, would not impress a molecular biologist. "When you look at the virus," Morse says, "it's really a nerd. It's poorly transmissible. It belongs to a group of viruses that causes disease very slowly and that were not associated with any human disease before HIV came along. It was not even associated with disease in its natural primate host. But the virus least likely to succeed has become the most severe health threat of our time."

Rather than a viral hunt, the most efficient surveillance system would probably resemble a fire department: worldwide monitoring of disease hot spots with the capacity for fast action to extinguish anything new before it spread. Donald Henderson, who spearheaded the international smallpox eradication program, argues for "the development of a network of internationally supported health centres" to be placed around major cities in the tropics. "A clinical facility in such an area would provide a window on events in surrounding areas."

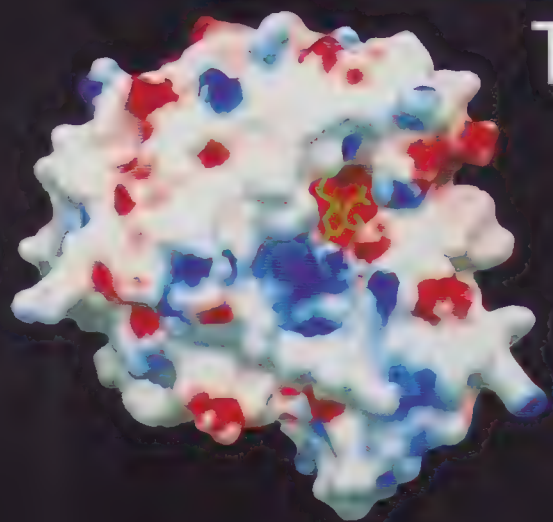
Any blips on the medical radar screen – unusual diseases or unusual numbers of patients – would attract immediate international attention. Henderson, currently the associate director for life sciences in U.S. President Bill Clinton's Office of Science and Technology Policy, says that 15 such tropical medical centres could be funded for US\$75 million per year. Another US\$75 million could keep existing United States facilities, such as the Centres for Disease Control, ready to react in conjunction with the international centres. His total figure of US\$150 million is no accident. It's the amount that the U.S. was spending in 1969 to protect its citizens against smallpox. "Today the United States spends zero dollars on these activities," Henderson reminds.

Just a few short years ago, Americans were seriously debating spending billions of dollars to create a very porous shield against nuclear weapons from the former Soviet Union, the now defunct Strategic Defence Initiative or 'Star Wars' concept proposed by former U.S. President Ronald Reagan. A medical surveillance program would be "100-fold more realistic than Star Wars and 100-fold less expensive," says Morse. "What we really want to do is make people aware that this is a real problem. It's not that we're going to have an epidemic next year. Something like AIDS does not come along every year. On the other hand, how many times does it have to happen? We don't want to have an AIDS epidemic even once. Look at what we've gone through with this epidemic. We want to look at this and resolve: never again. But if we don't learn from these experiences and act appropriately, we're going to be seeing it again." 



Ebola is one of the filoviruses, the nuclear weapons of the microbial world. When ebola hits humans the result is haemorrhagic fever producing "biological meltdown".

d



The shape of Drugs to come

by Mark Kestigian

Just when researchers were despairing of finding a way to conquer influenza, in comes the computer. Suddenly, traditional drug design looks positively prehistoric.

As high blood pressure gripped the hearts, minds and main arteries of a terrorised cholesterol-loving community during the 1970s, a race ensued among pharmaceutical companies to develop a drug that could combat hypertension.

Researchers knew how the drug – based on the venom from a South American pit viper – neutralised hypertension. It did this by inhibiting the action of the angiotensin converting enzyme (ACE) – a key component in the biochemistry of high blood pressure. They also knew that converting this knowledge into a workable product would be time consuming and extremely costly.

Using their knowledge of the molecular structure of ACE, they developed a synthetic molecule capable of blocking ACE, with the aid of an early and, nowadays, rather basic computer modelling system. It worked, and led to the production of Catopril in the mid-1970s, the first in a group of ACE inhibitors and one of the first so-called ‘rationally-designed’ drugs – a successful marriage between rational drug design and molecular modelling.

Molecular modelling and rational drug design are helping researchers tear strips off conventional testing techniques, enhancing drug development and reshaping the biotechnology and pharmaceutical industries. As a result, recent reports estimate that the total turnover in pharmaceutical spending has trebled since 1980 to about US\$90 billion.

Before computer-aided images helped design new drugs, researchers relied upon trial and error. They considered that one in every 10,000 attempts was outstanding, which explained why researchers typically spent years and several hundred million dollars trying to find a useful

chemical that will act as a cancer-killing agent or make cells stop creating a harmful protein. Luck, it seemed, played a far greater role in the research hand dealt to early biotechnologists than any systematic and carefully mapped out scientific plan of attack.

Naturally, researchers were receptive to applying the tools of high-level quantum chemistry – previously held hostage in NASA space labs and highly specialised university research centres – when they first emerged a decade or so ago. In anthropological terms, it was like being beamed up directly from the Stone Age to the present. Researchers can now convert chemistry data, usually made up of a blizzard of jumbled numbers on a computer printout, into visual images. This way, they can see their problems visually, and respond with a visual solution – a solution they might not have seen if they had only worked with numeric data. Rather than relying on luck, researchers can now engineer specific molecular structures to, say, block the action of a particular enzyme, like building a very complex chemical Meccano set.

Until recently, however, these molecular graphics packages required high-powered research scientists who not only knew what they were looking for, but knew how to feed customised programs into a computer. It was like being unable to drive a car unless you fully understood the physics of an internal combustion engine.

No longer. With ever-improving software flooding the market and access to international up-to-date information on findings from other leading scientists, researchers are able to visualise and manipulate the three-dimensional structure of molecules. They can also provide rapid and

detailed analyses of molecular properties, especially when closely coupled to molecular calculations. These graphics techniques are especially important in studying protein and macromolecular structures, where the molecule's size makes it difficult to appreciate the whole structure and precludes easy model-building.

At the body's atomic level, millions of cells and chemicals collide and coalesce. These dockings between cell receptors and chemicals occur constantly, responding to everything from sipping tea to talking, and create a special protein 'lock' on the cells' surfaces. Researchers faced the daunting task of screening thousands of chemicals in a hit-or-miss – mostly miss – process in the hope of finding one substance that could imitate this naturally-occurring locking system and dock with cell receptors.

While molecular modelling is associated primarily with pharmaceutically-based applications, scientists in other fields are entering the picture, including those involved in multiple sclerosis, heart disease, AIDS, rheumatoid arthritis and cancer, to name a few.

Professor Antony Burgess, director of the Ludwig Institute for Cancer Research in Melbourne, quickly became a convert to computer modelling when he realised how much quicker and more effective it made his work in the search for growth factors that control the production of blood cells and intestinal cells.

"Before computer modelling, it could take up to six months to create a new molecule that might prove useful in our work. We can now achieve it in 15 minutes," Burgess says.

In addition to the work carried out by Burgess and other leading researchers in Melbourne, the Ludwig Institute's computer network has on-line access to work being done overseas, giving them up-to-the-minute reports on the latest findings in the field. Burgess adds that computer modelling had even made an impact on experimentalists, many of whom were reluctant to welcome computer-generated images because they weren't 'real'. Many experimentalists believed that unless you generated images by such traditionally-accepted techniques as X-ray crystallography or nuclear magnetic resonance, then they couldn't be relied upon. This view has begun to change in recent years. "The fact is, the computer is far better at coming up with workable molecular models than most scientists are," he says.

It is the influenza virus research involving leading local scientists that has captured the imagination. While most people suffering from the annual aches and pains of various flu strains recover within a few days, about 40 million people have died from attacks by particularly virulent influenza viruses in this century alone.

What makes influenza such a tough nut for the immune system to crack is that, unlike many other viruses such as mumps and measles which are easily read and despatched following one attack, flu is a chameleon capable of catching people out several times in any given year.

It's that ability to constantly change and mutate that has led researchers like Dr Peter Colman, director of both the CSIRO's Division of Biomolecular Engineering and the Biomolecular Research Institute – a joint venture between the CSIRO and the Victorian Government's Strategic Industry Research Foundation – on a crusade in search of the holy grail: a flu cure.

There is a James Michener-sized book in describing the many twists and turns in his flu-virus work, but following vital information discovered by fellow researchers into specific proteins, called sialidase and hemagglutinin, contained in the influenza virus in the late 1970s, Colman began to question the conventional wisdom of the day. Earlier researchers believed that the key to unravelling the flu virus depended on stopping hemagglutinin proteins from locking onto cell membranes. Once they were able to gain a foothold, they could force their way inside the cell. The prevailing theory referred to the interaction between flu proteins and cells as a 'lock and key' arrangement. When the hemagglutinin pass-key was inserted into the cell membrane, the virus was able to quickly and profusely multiply.

The other flu protein, sialidase, then enters the picture. It acts like an ice-breaker on the front of an Antarctic-bound vessel, running interference and keeping the channel open for the virus to spread further through the host's system.

Rather than continue looking for some weak link in hemagglutinin, as many of their predecessors had done, Colman and associate Dr Jose Varghese wondered if there might be some part of the sialidase's molecular structure that remained the same regardless of the flu-strain. Colman's idea was that if they could find some similarity among the differing flu strains' molecular structures, it might be possible to plug it

with a drug design that was specifically tailored, or rationally-designed, for it. Once plugged, so the new theory went, it might give the body's immune system a fighting chance to ward off the infection.


What they eventually found was a complex molecule on the surface of the virus called neuraminidase which enables the virus to break free from a host cell and infect others. They also found a hole or pocket on the surface of this molecule that remained the same no matter how often the virus changed shape.

"From a purely scientific view, our research led to a radical reassessment of the way in which researchers had looked at flu viruses. It was a far cry from the 'lock and key' ideas that had predominated and also got us to thinking that it might be more possible to make a drug stick more tightly to sialidase than to hemagglutinin," Colman says.

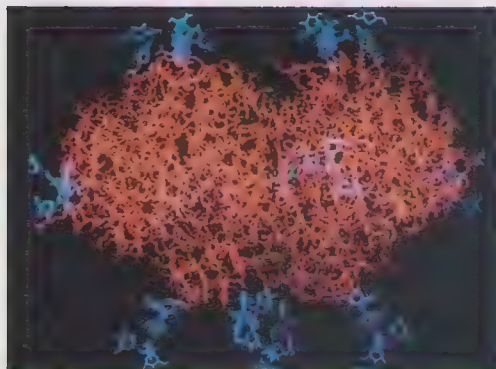
Other specialists – and financial backers – were recruited to continue Colman's work. Following discussions with the CSIRO, a small Melbourne-based company called Biota Holdings put up the funding and Dr Mark von Itzstein of Monash University's Victorian College of Pharmacy supplied the chemical expertise necessary to come up with a compound capable of filling the hole in the sialidase molecule of the flu virus.

This discovery didn't happen overnight. It took more than five years and countless trials before von Itzstein's team hit upon a workable compound with the alphabetical soup name of GR1211167X. Initial testing on mice and ferrets, conducted through financial backing and support from British pharmaceutical giant Glaxo, has proven successful. Glaxo is currently trialing it on humans in Europe and later this year in Australia. Ken Windle, managing director of Glaxo Australia, says it could take three to five years before any drug goes on the market – and that's the best case scenario.

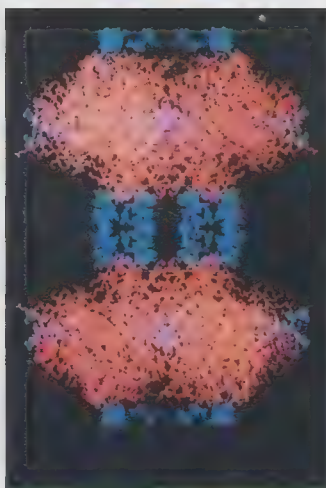
Though no-one is claiming victory over flu virus yet, the one thing everyone agrees on is the value of molecular modelling and rational drug design.

"A few years ago, there was a general feeling in the scientific community that molecular modelling gave researchers the ability to generate great pictures and little else. That certainly is no longer the case, as evidenced by the work achieved within the flu virus program," says von Itzstein. 

**"The computer is far better at coming up with workable**



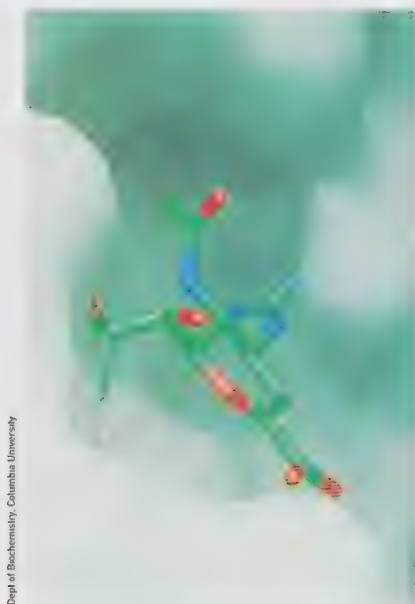
2



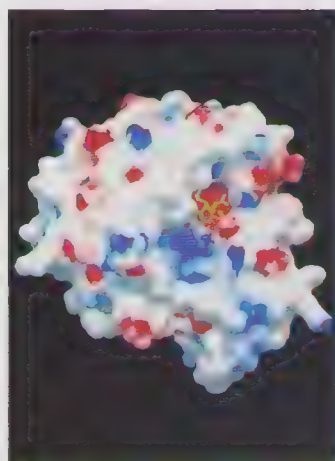
1



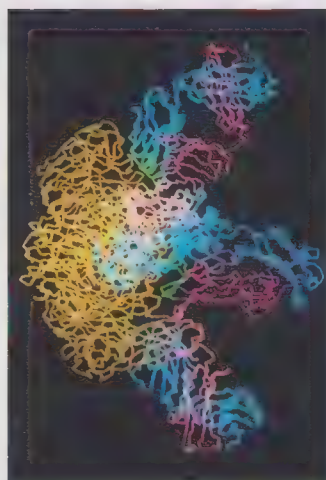
3



4



5



6

Computer modelling allows different perspectives of highly complex molecular images. (1 & 2) Neuraminidase in cross-section and close-up respectively. Neuraminidase enables the virus to break free from the host cell and infect others. (3) BRL researcher with a stick and ball model which would take up to six months to solve a problem that can now be solved with computer aided design in 15 minutes. (4) A close-up of (5), the sialidase proteins surrounding a pocket filled with drug compound in active site. (6) Sialic acid (yellow) binding in the active site of neuraminidase.

The images contained in this article represent computer-aided graphics that are still a relatively new phenomenon. Indeed, not long ago scientists relied on the ubiquitous stick-and-ball models that now sit around gathering dust in many laboratories.

Others preferred the so-called 'Richard's Box' technique in which sections of an electron density map were transferred to transparent sheets (usually 2-3 m<sup>2</sup>). These sheets, which were filled with tell-tale dots and squiggles, which were the researcher's equivalent to a road map detailing the microscopic world of the human body, were then sequentially stacked and illuminated by a light box. For particularly complex atomic-level viewings, these stacks could reach several feet in height and required a scientist with Superman's X-ray vision to properly translate.

Computer-aided graphics now offer a far more advanced three dimensional image that also allows for rotation, scaling and windowing of highly-complex molecular images in a variety of shapes and sizes. Researchers at the CSIRO's Division of Forest Products hit upon a similar application of sub-atomic animal, mineral and floral specimens a few years ago. The division uses a scanning electron microscope, which provides highly detailed views of objects magnified to more than 200,000 times their original size. The images are used by scientists for everything from gaining a better understanding of pollen sub-structures to finding out how tiny bits of asbestos become imbedded in the human lung.

Until recently, these images were in black and white, but co-developer of the colour process, John Ward, began experimenting with different colour filters. "The human eye can only pick out about 16 shades of grey across an image, whereas the information content of colour images can be much greater, making interpretation much easier," he explains.

This new method of real-time colourisation allows for the analogue signals from the various information sources contained in the microscope, to be simultaneously displayed to produce a colour image. The colours can be altered in real-time without the necessity to revert to computer-based colour palettes or digitisation. The resultant image can then be displayed on a colour monitor and may be transferred to various hard copy devices including videotape, freeze frames and cameras directly off the screen.

molecular models than most scientists are."

# ROMANCING THE

by Maria Russell

From the genetics which inspired 'Jurassic Park' to uncovering the fate of the 5,000 old Ice Man Ötze, Tom Loy is one unheralded researcher busy bringing the past to life.

Dr Tom Loy is one of Australia's best kept scientific secrets. He has been frequently interviewed by *The New York Times*, appears as the only non-fictional name in the best-selling Michael Crichton book, *Jurassic Park*, and is one of a handful of scientists with access to the Ice Man – the 5,000 year old mummified hunter found recently in the Austrian Alps.

Yet Tom Loy continues to work quietly in his laboratory in Canberra with surprisingly little fanfare from the Australian scientific or mainstream press. Loy, of the Department of Prehistory in the Research School for Pacific and Asian Studies at the Australian National University, is a pioneer in the analysis of ancient genetic material. His research into the DNA of blood remains, found on prehistoric tools, forms the basis of Crichton's book, which was the stimulus for director Steven Spielberg's blockbuster movie of the same name.

Loy has never spoken to Crichton, but believes that the author saw one of his articles, published in 1990, which describes the science of extracting proteins from very old bones. In the paper, Loy speculates that DNA, the genetic blueprint of life, could be successfully extracted from ancient specimens, relatively intact. "It is possible that this basic premise

forms the heart of *Jurassic Park*," he says.

The Canadian-born Loy first came to world attention in 1983 with an article in the prestigious U.S. journal, *Science*. Through careful, meticulous research Loy proved that blood residues retain enough of their original characteristics to identify the species from which they came. Previously scientists had never examined artefacts for blood, believing the proteins and haemoglobins could not have survived in an unprotected state. Loy's paper opened up a fascinating new technique for examining the lives of prehistoric people and the article was heralded as creating a whole new sub-field of archaeology – molecular anthropology.

In the early 1980s, scientists at the San Diego Zoo were working on ways to crystallise haemaoglobin. Using the blood contents of mosquito stomachs, the researchers hoped to be able to identify the carriers of the disease equine encephalitis. While the experiment failed to isolate the disease vectors, the method was adapted by Loy to crystallise blood fragments found on stone tools.

He refined the technique throughout the 1980s – however, it was the advent of a method called polymerase chain reaction, or PCR, which

# STONE AGE



advanced his research by leaps and bounds. PCR enables scientists to take very small amounts of genetic material and amplify it to a usable amount. In this way, microscopic amounts of blood and hair DNA on an ancient stone tool can be expanded to the level where experiments and analysis can be performed.

While the technology was advancing, Loy's career was not. In 1987 the Provincial Museum of British Columbia in Canada, where Loy had a position, had decided his research was outside their mandate and Loy was forced to look elsewhere. "Australia was the first place to offer me a job – I also had the sense that the ANU department was quite willing and ready to experiment with new techniques and methods – which remains true to this day," he says.

Two years earlier Loy had spent six weeks at ANU – a period he considers invaluable. "By the time I was deciding whether to come to Australia – I already knew that Aboriginal artefacts existed with blood remains on them – and that the Australian climate was not so harsh that these residues were destroyed," he says.

Since arriving in Canberra, Loy has been examining the remains of extinct Australian fauna – such as the giant kangaroo – in order to determine why these megafauna, as they are called, died out 18,000 years ago. According to Loy, megafauna became extinct in North America just as humans were becoming established. While it is believed that humans may have contributed to the demise of these large mammals, there is little proof. "In Australia, humans and megafauna lived side-by-side. We are collecting blood residues from tools found in all parts of the country; from this it should be possible to determine the extent to which these animals were hunted," he says.

The aim is to develop a library of DNA samples taken from extinct Australian megafauna – this library can then be used to look at blood residues on ancient tools. Loy recently obtained DNA from a sea-dwelling mammal found in Queensland. The animal, a plesiosaur, died 160 million years ago in the Jurassic Era.

Loy obviously relishes the idea of debunking accepted scientific theories. Using DNA isolation techniques, he has disproved theories about the archaeological origins of agriculture.

The birthplace of agriculture had long been believed to lie in the "fertile crescent" of Mesopotamia, roughly centred around present-day Iraq. However, microscopic plant residues found on stone tools in the Solomon Islands, in the Pacific Ocean, indicate that the islanders were practising farming 20,000 years before the Mesopotamians.

For many years archaeologists maintained that the people living along the Tigris and Euphrates Rivers in Mesopotamia started harvesting wheat crops about 10,000 years ago. The rapid development of agriculture led to a constant supply of food, enabling permanent communities to develop – eventually giving rise to the civilisation of the Middle East.

However, since the 1980s scientists have been finding evidence of farming in places such as Egypt and Papua New Guinea and islands in the Pacific Ocean, indicating that agriculture evolved in a few places rather than developing primarily in Mesopotamia. The oldest of these tools were found in 1987 at Kilu Cave on Buka Island in the Solomon Islands. Radiocarbon dating places the artefacts at 28,000 years old. Loy

Austral



Preserved in the ice of the Austrian Alps for 5,000 years, the Ice Man was finally discovered by hikers in September 1991.

has studied these tools and found microscopic remains of starch grains and long, sharp crystals known as raphides – found in such plants as nettles.

By comparing these residues with a reference collection of food plants used in the South Pacific today, he found that the ancient remains came from the roots of two species of taro. The remains more closely resembled domestic strains of taro rather than the wild strains – hinting that migrants to the Solomon Islands must have either brought domestic strains of taro with them from South-east Asia or modified wild stock.

Loy acknowledges that the taro residues only confirm that plants were being manipulated 28,000 years ago – they do not actually provide evidence for cultivation. “Taro is a low-maintenance plant – people may well have been cultivating it but there would be little evidence of any cultivation,” he says.

However the picture that is emerging is one of a crop-based culture that developed slowly, in many centres rather than being first discovered in Mesopotamia.

More recently Loy travelled to Germany to study the tools and implements of Ötze – the prehistoric man whose body was preserved in the ice of the Austrian Alps on the Austrian-Italian border for more than 5,000 years.

Loy joins 64 international research teams who have been invited to study the frozen body. Ötze is named after the Ötztal Mountains where the body was discovered in September

1991 by hikers. Carbon dating records his death at between 3400 and 3100 BC.

The scientific value of Ötze lies in his ordinariness – unlike the mummified remains of kings and queens which have been uncovered by archaeologists – Ötze was a simple hunter and his almost perfectly preserved body provides researchers with the first real insight into normal life 5,000 years ago.

Loy spent two weeks last November examining the Iceman’s belongings at the Roman-German Central Museum in Mainz, Germany. “That included 70 hours of microscope time and the collection of 52 samples of residues containing DNA and protein to bring home for further study,” Loy says. Ötze’s body is undergoing forensic tests elsewhere in Innsbruck.

According to Loy, blood and hair on Ötze’s knives and other tools reveals that he had recently killed deer and goats.

Loy believes Ötze spent his last hours mending a copper axe and eating a meal. Remnants of starch were found, by Loy, on both the tip of a blade and where the blade attaches to the handle. Ötze was probably eating a porridge of barley, or a similar cereal, accidentally transferring the food from the hand to the blade.

Loy believes Ötze was a hunter – rather than a shepherd or explorer as had been previously assumed – because hairs on his tools indicate he killed red deer, chamois, “an Alpine goat” and ibex, another type of mountain goat.

Loy speaks of the Ice Man with reverence and insists Ötze was a hunter. “I had a lot of experience with ancient hunters in North America, and I could see that Ötze’s tool kit was extremely complete. There were lots of tools, lots of spare parts, very portable,” he says. “The overall impression was that he was a very careful person.”

Tiny flint blades, about 3 cm long, were found near the body. These, Loy says, were used to scrape the skins from animals for clothes and to shape bones and antlers for tools. Loy believes a bundle of sharpened bones, lashed together with fibres, could have been made to hunt birds.

Ötze was mending two arrows when he died – perhaps, Loy speculates, he had separated from a hunting group to mend his weapons.

**“Will it be possible to use Ötze’s DNA to clone a living Ice Man, re-creating a prehistoric man? Loy believes the idea is not as fictional as it sounds.”**

“In those times, in a harsh climate – when something goes wrong it tends to trigger a series of circumstances,” Loy says. Ötze may have been sick or injured and found himself in a high mountain pass with no wood and he died from exposure, Loy reasons.

Because the body has spent thousands of years compressed under layers of ice, and as yet no postmortem has been done, it is impossible to tell the true cause of Ötze’s death. However, in life, Loy says that Ötze was a “mature elder of 35 years who was probably an expert hunter”.

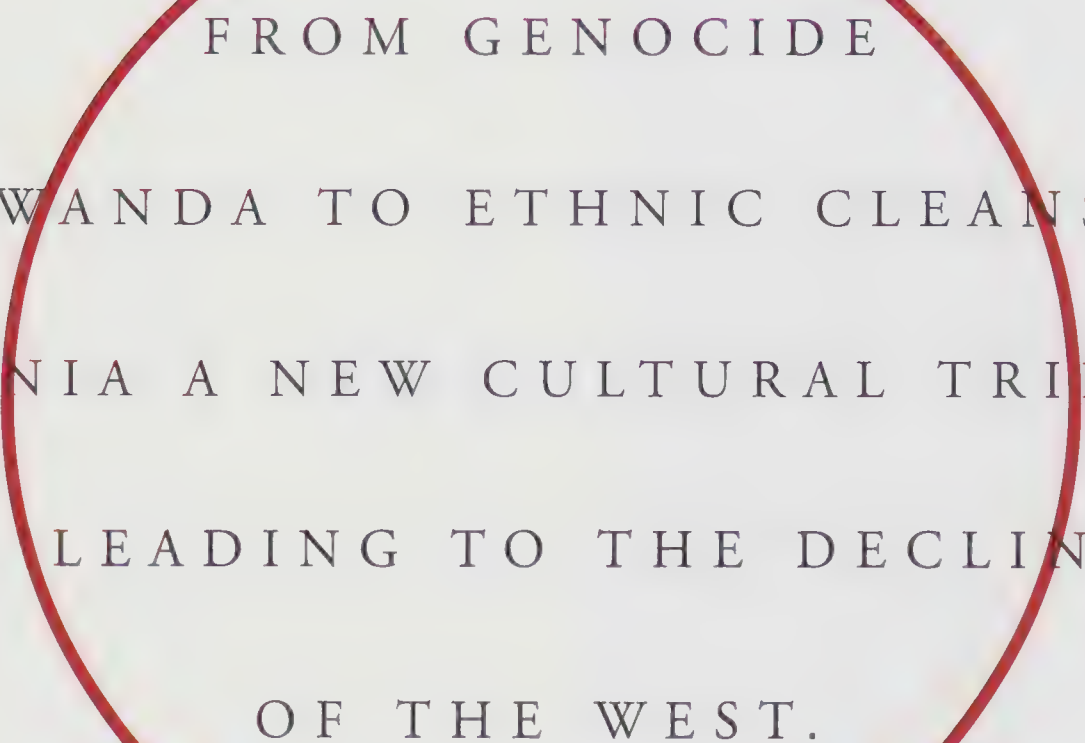
With Dr Markus Egg, from the museum in Mainz, Loy hopes to compare Ötze’s hair and blood with DNA from samples from nearby burial sites in order to determine where the Ice Man came from.

Will it be possible to use Ötze’s DNA to clone a living Ice Man – to use the *Jurassic Park* idea to re-create prehistoric man?

Loy believes the idea is not as fictional as it first seems. “The technology that has been suggested is not as crazy as it sounds. If we want to put the resources into isolating the whole genome of a dinosaur, or an ancient man, then we can do it – but the scale of the resources needed would be huge,” he says.

“At the moment we simply do not have the technology to put the entire genome [of the Ice Man] back in the correct sequence. But who’s to say we won’t be able to in the future?”

**The Ice Man’s almost perfectly preserved body provides researchers with the first real insight into normal life 5,000 years ago.**



FROM GENOCIDE  
IN RWANDA TO ETHNIC CLEANSING  
IN BOSNIA A NEW CULTURAL TRIBALISM  
IS LEADING TO THE DECLINE  
OF THE WEST.

# THE COMPLAINT OF CULTURE

by Wilson da Silva

Hutus and Tutsis massacred in Rwanda. Turkish hostels aflame in Germany. Fleeing Kurds gunned down by Iraqi tanks. Ethnic cleansing in Bosnia. American blacks rioting in Los Angeles.

Every day, new images of conflict cascade down satellite feeds and into the living rooms of the world. Slowly, almost imperceptibly, a trend emerges in the mind of the viewer. Could it be that all of these events are linked by some new force? Is the explosion of racial and ethnic violence of the 1990s just the backwash of collapsing nation-states, the decay of the old East-West hegemony and the proliferation of weapons? Or – perhaps more ominously – is this the rise of a new social ill?

Speak to some researchers in the field, and you get the impression something new is happening in global society at the end of the 20th century, something not seen before in human affairs. The collapse of nation-states and the economic slowdown of the once mighty West, coupled with the mass availability of large-scale weapons, is being enjoined by a new cultural phenomenon – something that might be termed *cultural tribalism*.

Around the world, conflicts are erupting that have little to do with race or religion and precious little to do with ethnicity. The industrialised West, Eastern Europe and the former Soviet Union – all creations of the political Enlightenment of last century – are starting to fragment. It is more dramatic in the old Communist Bloc, but there is also a rising

divisiveness in the West: Québec and Canada, the separatist ground swell of Italy's Northern League and the fraying of the United States into a cacophony of clamouring pressure groups.

Many of the fissures are opening up along racial or ethnic fault lines. But not all. Some groups are heightening their differences so that they can better claim to be distinct. They are claiming a *distinctness* that can be defined as *culture*, and these differences are becoming a basis for conflict. The deaf, gays, lesbians, women, African-Americans – more vocal proponents are claiming intrinsic cultural differences and, more importantly, the right to define what makes up those differences.

"In a way, it's the sort of the old decline and fall of the Roman Empire," says Joel Kahn, professor of anthropology at Melbourne's La Trobe University. "The West is now becoming – this is certainly how Asians look at us – a decadent society concerned with our individual identities and sexuality and so forth. We've lost that confidence and therefore we start worshipping primitivism, environment and that sort of thing.

"Why are George Bush and Bill Clinton worried about the collapse of the American dream?" Kahn asks. "It's the lack of some kind of confidence, not just at the top but from the middle classes, that seems to me to partly explain what is going on there. I suddenly decide as a middle class American that I've had it with America and what's important is my Jewish identity. I can now see through all the garbage of the American dream."



Turkey: Kurds rush a U.S. helicopter bringing food (April 1991)  
(Les Stone/Sygma)



Deaf activists demonstrating in Paris against the use of cochlear implants which they argue will deprive young, deaf people from experiencing 'deaf culture'

Perhaps this cultural tribalism, if it is indeed a phenomenon, is more visible in the West because of its pluralist philosophy, which might be said to consider 'live and let live' its credo and multiculturalism its pinnacle. But what happens when the language of multiculturalism is appropriated by non-ethnic sub-groups? When 'life, liberty and the pursuit of happiness' doesn't deliver equality of opportunity for homosexuals, they might see themselves as victims of an oppressive heterosexual culture. But does this make gays and lesbians a distinct cultural group? If the American black-nationalist religious group, the Nation of Islam, speaks of African-American culture, is it also speaking for the black urban ghetto dwellers of U.S. cities? If a group has no shared cultural experience – save discrimination by whites – does that make it a distinct culture? Or, in the case of homosexuals, can no link but one of sexual preference really be the defining characteristic of a separate culture?

"There is this fundamental shift from culture as essence, to culture as expression," says Chris McAuliffe, a Melbourne University lecturer with specific interest in cultural studies. "You get a Bosnian saying 'I've got a culture that goes back centuries that is the essential core of my being'; but then you've got a Bosnian *defining* his or her own culture, here and now, by shooting someone who isn't one. The conflict is supposedly generated by the need to preserve that culture, but preservation is not what is being done. It is the conflict that allows them to define their identity;

in a world with tremendous rates of migration and intermarriage – it became obvious that race was a construct itself. It drew a line – you're either on that side or on the other side, a line based on any of the features to define race. But this has to be arbitrary; either someone decides what race you belong to, or you decide yourself. Culture is now the same; it is a kind of self-identification or identification by others which rests on an arbitrary line and says that you can be put into one box or another.

"And yet, of course, nobody fits. It isn't just a case of what's going on in Rwanda, it's a question of what is going on here or the U.S. or else-where. Why is the world wedded these days to a discourse of human difference in discrete groups?" Kahn asks.

Can the killing fields of Bosnia and Rwanda be linked to this emerging phenomenon? Social scientists are unsure. Many of the factors mentioned appear to be at work; the decline of the nation-state, economic decay, the proliferation of weapons, and cultural tribalism. All agree that the authority of the state has to break down before tensions rise to a violent flashpoint, and that this, coupled with economic woes, is sparking conflicts like Rwanda and Somalia.

"African states have been collapsing for years, and nobody noticed it. Somalia, Ethiopia, Mozambique, Rwanda – in all of those cases, there have been large-scale massacres in the past few years," says Dr James Jupp of Canberra's Australian National University. "But they haven't nec-

## Culture...now is being touted almost as if it were a scientifically measurable difference

whereas they will say the conflict is about *defending* their identity."

Culture has always been an artificial human construct. But now it is being touted almost as if it were a scientifically measurable difference: "We very often see culture now almost like race, as though it were there and hard-wired into the brain," Kahn says. "So that someone who is a Serb, is a Serb and there's almost nothing they can do about it; one *identifies* one as a Serb or is *identified* as a Serb, and that's what creates *Serbianess*."

The language of separateness being used – in which cultures claim a right to be whatever it is they define themselves to be – is a new one, sociologists say. It is, as Canadian philosopher Charles Taylor points out, an appropriation of the liberal language in which individuals are allowed free creative self-expression, suddenly applied to culture. It is now acceptable to say 'I have the right to my *own* cultural heritage and it has to be respected'. When deaf parents deny their deaf children cochlear implants, they argue that to give them hearing would freeze their children out of 'deaf culture', a culture which they themselves define.

What is striking about this new language of innate human difference for culture is that it resembles the same language once used to construct differences on the basis of race.

"What it suggests to me is that what is going on in the Soviet Union and what is going on in Rwanda might be connected," Kahn says. "Everybody now is talking about the integrity of different cultures, different religions and different identities, not just people in Yugoslavia.

"Even the biologists gradually abandoned the notion of race, especially

essarily been ethnic. The state has broken down in a number of African countries due to poverty, illiteracy, incompetency and corruption... and some are considerably poorer than they were at independence. Also, many of these states are heavily armed; they're not just using rifles and swords like they might have in the last century, they're using rockets and God knows what."

Collapse of order is triggering waves of violence that quickly turn to genocide. Not just in Africa, but also in Bosnia; it is being enacted against the Kurds in Turkey and northern Iraq; against native Indians in Brazil's rainforests; against ethnic Vietnamese in northern Cambodia and, in a more subtle form, in East Timor, where an initial invasion by Indonesia in 1975 – which wiped out an estimated one third of the population through war, disease and starvation – has been followed by large-scale transmigration which is slowly diluting the Timorese presence.

Jupp, director of ANU's Centre for Immigration and Multicultural Studies, says much of the genocide that plays almost nightly on our television screens has been happening for centuries. "People in Bosnia used to live quite happily side by side, but every so often they did in fact come into open conflict. They massacred thousands and thousands of people in the First World War and hundreds of thousands in the Second World War. And now they're doing it again. It's not a new thing, it's just that we've got television now. A lot more people would know about Bosnia now than would have known about it in 1940 or 1920 [the

time of the other great massacres] because they read about it in the newspapers and see it every day on television. Take Rwanda: how many people would have heard of it until a few months ago? Television now spreads the news much quicker. There are more people in the world, there are more governments in the world and there are more weapons in the world, and the information travels much faster.”

Genocide may be ugly, but it may also be a part of human nature; and not even the exclusive preserve of humans, as recent research has found. Noted American biologist Jared Diamond in his influential book, *The Rise and Fall of the Third Chimpanzee*, argues that humans have an inherent genocidal tendency that can also be found in our evolutionary cousins, the chimpanzees. But what is new, he says, is that – thanks to technology – humans are now capable of amplifying that genocidal capability to staggering proportions. “Together with our destruction of our environmental resources, our genocidal tendencies, coupled with nuclear weapons, now constitute the two most likely means by which the humans species may reverse all of its progress overnight,” he writes.

the lame and the short – or, to put it more correctly, the differently abled, the other-visioned and the vertically challenged. Never before in human history were so many acronyms pursuing identity.”

Some argue that the over-zealous application of political correctness has become an all-encompassing movement that now uses a language similar to those of the racists. It seeks to exclude rather than debate those that do not toe the line: Gentiles who criticise Israel are labelled ‘anti-Semites’ and Jews who do likewise are ‘self-haters’; when an anti-abortionist tries to debate a pro-choice advocate, pro-choice protesters can drown out the anti-abortionist’s views and call it a victory for progressives. In that exclusion, the differences within a society are accentuated, making it more difficult for the consensus of acceptance, that is the hallmark of multiculturalism and a pluralist society, to survive.

And yet, while Western-inspired nation-states established during the Enlightenment are going through convulsions, younger states which are experiencing rapid economic growth are actually consolidating



Ethnic Cleansing in Bosnia Herzegovina: Croatian civilians killed by retreating Serbs (April 1992) (Sygma)

Muslim and Croat prisoners arrive in a Serb prison camp in Bosnia where the first formality is to get their hair cut (Andrée Kaiser/Sipa Press)

Desperate for food, Kurds swarm an aid vehicle (Patrick Robert/Sygma)

What may be new on this front is the emergence – or perhaps re-emergence from more ancient times – of social genocide. In Brazil, criminal suspects are regularly executed on the streets by vigilante death squads. Street children, slum dwellers, indigenous people and farm workers involved in land conflicts are also systematically threatened, disappear or are killed.

If culture is now becoming the definer that race used to be, and sub-cultures are claiming the rights of the individual, is there any hope of survival for the pluralist ideals that are the basis of modern Western society?


Historian and art critic Robert Hughes doesn’t have the answers. But he points out in his book of essays on the fraying of the United States, *Culture of Complaint*, that the destruction of pluralist principles and the ensuing fragmentation of American culture is being aided and abetted by the tightening straitjacket of political correctness. An Orwellian process of altering the language without actually changing the ills of a discriminatory culture is under way, Hughes points out: “The range of victims available 10 years ago – blacks, Chicanos, Indians, women, homosexuals – has now expanded to include every permutation of the halt, the blind,

their nationhood. Singapore, Malaysia, Taiwan and South Korea are all becoming more cohesive.

“These countries are doing well and they are more cohesive; they have more of a collective sense at the moment,” says Jupp. “They are expanding so rapidly that everyone is expecting things to get better. They are now richer than the countries of Eastern Europe. They have got much more to offer to their people, so they hang together fairly well.”

The interesting question raised by this is, are we witnessing the fall of pluralism and Western democratic ideals along with the economic disrepair of the West, to be replaced by a new model – perhaps a sort of Stalinist capitalism exemplified by some of the more authoritarian Asian states? While researchers agree the West is in decline, few are predicting its impending collapse.

“The great days of Britain are gone and the great days of America are probably drawing to a close,” says Jupp. “Economic growth in the West has slowed down in the last 20 years; whereas everybody had expected it to go on expanding, and it isn’t doing so.

“The West may be in decline, but they’ve still got a long way to go.” 



Keep your hands

by Darryl Ribaux

**Research into the genetic cause of homosexuality may have a chilling outcome: the genetic manipulation of human behaviour.**

# off our genes

It used to be a bit of a joke; when asked why they were homosexual the reply was 'Oh, my mother made me this way.' But according to research into the biological causes of homosexuality, especially by Dr Dean Hamer, that standard reply may no longer be uttered so facetiously.

Under the umbrella of the Human Genome Project, co-ordinated by the United States' National Institutes of Health, researchers are currently mapping human genes at the rate of one per day. The goal of the project is to identify a complete set of human genes. The aim: to treat and prevent human disease.

The media regularly trumpet the finding of a gene responsible for a particular pathology. But it is not only diseases that researchers are preoccupied with which. Some are attempting to find genetic 'causes' for the complex issue of human behaviour. This search for genetic causation is part of a broader intellectual environment where biological, rather than environmental, factors are being favoured as the reason for behaviour.

But along with the ability to find genetic causes for behaviour comes the danger of attempts to modify behaviour, especially those things seen as 'different'. Like Homosexuality.

The debate about what 'causes' homosexuality goes back to Aristotle. Homosexual orientation has been seen as either innate or voluntary, or, as through much of this century, the result of nurture. Around the turn of the 20th century French and German scientists began to explain same-sex preference in biological terms. And if it was physical, then of course 'cures' could be attempted. Castration, vasectomy and sterilisation were undertaken in an attempt to rid the 'sufferer' of his homosexuality. Lesbians were, in general, invisible and ignored.

In the 1920s, psychological explanations came to the fore, with homosexuality being explained as a developmental disorder. Analysis and aversion therapy such as shock treatment were used in the hope of effecting a

heterosexual adjustment. If homosexuality was conditioned rather than innate, then re-conditioning could occur. As recently as 1979 some West German physicians were destroying part of the hypothalamus in gay men. It was in this part of the brain, they theorised, that the female centre of the brain was located.

Not all therapy concentrated on change. Many psychiatrists and psychologists believed that such things couldn't be changed and that the best that could be done was to help the 'patient' come to terms with their 'problem'. It wasn't until 1973 that the American Psychiatric Association removed homosexuality from its manual of psychiatric disorders.

In July 1993, Dr Dean Hamer published a report in *Science* magazine which claimed to have identified the area (on the X-chromosome) where the gene that predisposes men to homosexuality resides. The finding immediately raised concerns that gene therapy might become the *latest* method in a long line of attempts to 'cure' homosexuality.

Just as invitro fertilisation technology caught society off-guard, genetic research and existing and hypothetical gene therapy procedures present similar dilemmas. Is the research and its technological application developing too fast for society to make rational judgements about it? While nobody would raise objections to the search for the cause and treatment of a pathology like cystic fibrosis, fears are aroused when the methods of correction, such as gene therapy (in which a defective gene is replaced by a healthy one), could theoretically be used to 'treat' behavioural 'disorder'.

And gene therapy is not just hypothetical. Trials are already being undertaken into various pathologies.

One thing that will influence any development of gene therapy procedures is that the knowledge base is incomplete at best. Researchers are unsure how genes do what they do, let alone how they interact with each other. Tampering with a gene may impact on other processes in the body. Or a person's behaviour. The consequences are unknown.

Leone Skene, senior lecturer in medical law at the University of Melbourne says that while there are no Australia-wide statutory laws in regard to the use of gene therapy, there is the Ethics Committee Procedure, controlled by guidelines of the National Health and Medical Research Council, the main body of medical research funding in Australia.

"They have published guidelines which say experimental procedures involving people should be approved by an institutional ethics committee," says Skene. "While these guidelines don't have the affect of law passed by parliament, they are a very clear statement of what is acceptable."

In Australia, regulation of gene therapy procedures is covered by the Statement on Human Experimentation, a series of guidelines which includes ethics committees. A supplementary note added in 1987 concerns gene therapy.

"There is a distinction to be made between somatic cell gene therapy which affects the body's cells, and genetic changes to reproductive cells and fertilised ova," says Skene. "There are procedures to be followed for somatic cell gene therapy. The supplementary note states that 'The therapy should be attempted only in diseases of which the cause is a defect in a single pair of genes. Gene therapy to correct defects in multiple genes should not be attempted... While the development of somatic cell gene therapy is acceptable, the introduction of DNA into germ (reproductive) cells or fertilised ova for the purposes of gene therapy is not, because there is insufficient knowledge about the possible consequences, hazards and effects on future generations.'"

Any attempt to practise gene therapy on humans would have to be approved by a hospital or institute ethics committee whose role is to consider whether the patient has been fully informed about a proposed procedure. One could not simply request gene therapy; a doctor must decide on the basis of clinical judgement about a condition. In the scenario where there is a 'gay' gene, and there are technological processes to modify

it, it will be the medical profession and ethics committees that will decide whether such therapy can proceed. And they will be influenced by government policy and public opinion, both influenced heavily by religion.

At the end of Dr Dean Hamer's report on the gay gene is the statement that, as the Human Genome Project proceeds, it is likely that correlations between genes and behaviour will be discovered. Hamer concluded that "it would be fundamentally unethical to use such information to try to assess or alter a person's current or future sexual orientation, either heterosexual or homosexual, or other normal attributes of human behaviour. Rather, scientists, educators, policy-makers, and the public should work together to ensure that such research is used to benefit all members of society."

But 'benefit' is a value judgement and, as such, some sections of society will have very different ideas about how such research can and should be used. This was illustrated by the public reaction to Hamer's findings, ranging from the U.K. *Daily Mail* headline "Abortion Hope After 'Gay Genes' Finding" to sections of the gay community saying "we told you so".

By far the most controversial response to date was from the former Chief Rabbi of Britain, Lord Jakobovits, who stated in response to Hamer's report that, "If we could, by some form of genetic engineering, eliminate these trends, we should – so long as it is done for therapeutic purposes."

The chief medical ethics adviser to the cabinet of the Chief Rabbi, Dr Nisson Shulman agreed and recommended to the cabinet that if the technology became available, Jews should be able to voluntarily use genetic engineering to remove homosexual tendencies. He did, however, rule out the use of abortion as a solution.

Not all British Jewish groups agreed. The Union of Liberal and Progressive Synagogues described Lord Jakobovits' view as "rather disgusting" while a gay Jewish group compared his argument with practices against Jews by the Nazis during World War Two.

The reaction from the Catholic Church is not so definite. Nicholas Tonti-Filippini, of Melbourne's St Vincent's Bioethics Centre, and a Catholic Church spokesman formerly, says, "There is no official or definitive response by the church to the possibility [of the manipulation of a homosexual gene] but there are two lines of argument. One argument asks the question: is the human person an artefact or an icon? An artefact can be changed and adapted but an icon doesn't change and is regarded as sacred. If the identity of the individual is bound up with the genetic structure, then if you were to entirely alter the genetic structure, you are in fact altering who the person is – you're interfering with something sacred. You have to accept the person as they are.

"The other argument is that if you have a genetic structure which is diseased, which would cause suffering and hardship to the individual, then you would be entitled to correct the damage, and that is still retaining respect for the person. One says that these kinds of things are legitimate and the other says they are not because you're interfering with the sacred-

ness of the person," says Tonti-Filippini. "Homosexuality has emerged in different times in religious orders and a lot of effort went into using psychological and psychiatric techniques to change the person's sexual preference. The church was clearly prepared to use that. It was a dismal failure."

Dean Hamer and neuroscientist Simon LeVay believe that finding a biological cause for homosexuality can only be a good thing, arguing that discrimination exists because the sexual preference of gay men and lesbians is seen as a matter of choice. If homosexuality is seen as immutable, putting it on par with race and gender, then there will be no basis for discrimination. In response to such claims, Dennis Altman, associate professor of politics at La Trobe University and author of *Homosexual Oppression and Liberation* – the international gay movement's equivalent to *The Female Eunuch* – says: "I think they are clearly both naive."

"I don't think they have found what they think they have. I don't think it [acceptance] necessarily works that way," Altman says. "People who are hostile will turn around and say, well if there is a genetic cause, well let's use genetic engineering to remove it. I think there's this positivist belief that if you could just prove that people were born this way then it would resolve all the moral and political questions. I just don't think that's the case."

Adam Carr, acting editor of *Outrage*, Australia's largest selling gay magazine, also doubts LeVay and Hamer's optimism: "It may be that some people will be influenced if it were shown that homosexuality is something people have no control over. But popular homophobia is not based on those kinds of thought processes. I don't think it will make one bit of difference to political arguments about gay rights, about whether we win those victories or not."

Others in the gay community believe there is an agenda behind the research; that the study of human sexuality has tended to work from a set of value assumptions that assume that homosexuality is a disorder. Given that the aim of the Human Genome Project is to treat and prevent diseases, and that most genetic research has been undertaken to understand and control such pathologies as cystic fibrosis and Parkinson's disease, it is no wonder that some gays and lesbians are nervous. But then what is to be made of the fact that LeVay and Hamer are both gay men?

Many argue that homosexuality is not a disorder or dysfunction. So why the search for causes? Adam Carr believes the gay community should be careful about being perceived as censors of knowledge.

"I don't think you can argue against knowledge," he says. "You can't argue that certain questions are off limits for being investigated. I think that [investigating] why there are differences in human sexuality is as legitimate a question for scientists to research as any other. It's very bad if the gay community admit that we are in a position where our esteem is dependent on a certain lack of knowledge about human sexuality – that somehow the community will be destroyed or threatened if certain things are found to be true. It's an indefensible position to take."

While arguing that knowledge is neither good nor bad – only the uses it is put to, Altman wonders about all the media attention: "My concern is the media pre-occupation. I still don't understand why people think that this is so interesting when the research is based on such a small number of people and when fairly respectable people are saying that it is probably pretty shonky. I think that's the real question. I don't know why anyone cares what a former Chief Rabbi says. Why are people running around desperately trying to get people to say controversial things about not very good research?"

Dean Hamer is certainly aware that science does not operate in a vacuum. He has used the example of the abortion of female fetuses in certain Third World societies and argues that it is not technology that causes the abortions but economic and religious prejudices. He is also obviously aware of the possible consequences of his research. At this year's annual meeting of

**The finding immediately raised concerns that gene therapy might become the latest method in a long line of attempts to 'cure' homosexuality.**

the American Association for the Advancement of Science he stated that if he identified the gene which caused the predisposition to homosexuality then he would attempt to "patent it and claim the right to keep it from being used for social purposes" such as pre-natal screening, in order to slow such attempts down.

Leone Skene doubts that the patent would be overly effective.

"I think that the patent would be some sort of test for identifying where the gene is," she says. "Then that test would not be available without paying him a premium. And he can sue them if they use it without going through that procedure. He can't just stop it being used altogether. That is not what patenting does."

If Hamer wants to slow the development of such screening in countries outside the United States he would have to register a patent in each country and be prepared to defend it, if challenged, in the courts.

While the possibility of such screening in countries like Australia seems

unlikely, China last year announced a program to "avoid births of inferior quality and heighten the standards" with the chosen methods of forced sterilisation and abortion. Singapore's Lee Kuan Yew also has definite opinions on what 'sort' of citizens are best for a society.

"I'd be very surprised if anybody in China thought it was worth spending their health budget on screening babies for gay genes," says Adam Carr. "If Singapore wants to do nasty things to gays it is going to do them regardless of whatever method they use to do it. That would have to be taken up as an international human rights question."

But then human rights abuse need not be found only in such screening processes. In most Western countries discrimination has been less extreme but shamefully prevalent. Perhaps the most propitious consequence of Hamer's gene research is that the quest for knowledge has revealed these prejudices. Potentially it will make us less ignorant and force us to come to terms with what homosexuality is, a matter of freedom. ■

The recent report on the possible existence of a 'gay gene' by Dr Dean Hamer is one of many research projects over the last decade that have explored the possibility of a biological basis for same-sex preference.

Simon LeVay's report in *Science* in 1991 generated publicity and discussion in the general public of debates that had been going on in scientific circles for some time.

LeVay, then a neuroscientist at the Salk Institute in San Diego, studied the brains of 19 presumed homosexual men who had died of AIDS, 16 presumed heterosexual men (six of whom had died of AIDS) and six presumed heterosexual women. He concluded that there were anatomical differences between the brains of gay and heterosexual men and this difference resulted from hormonal activity on the brain of the developing foetus. The anatomical difference was the INAH 3 nucleus – a cluster of cells in the hypothalamus – which was, on average, only half the size in gay men and women than that of the heterosexual men studied. Essentially this reinforced the previous research on rats. Previous research in rats had suggested that the hypothalamus plays a role in sexual behaviour. LeVay argues that INAH3 engenders sexual interest in women and is an explanation for the size differential.

There have been many criticisms of LeVay's research. They include that some gay men had INAH 3 as large as heterosexual men, that not all the subjects studied had died of AIDS, and that HIV and AIDS could have caused neurological changes in the brains studied.

Another criticism has been that the size of the nucleus could be the result of sexual behaviour rather than the cause of it. Others have argued that homosexuality is not a lack of interest in women but a sexual interest in men – that LeVay should be looking for the site governing sexual interest in men.

From research in the mid-1980s on patterns

of homosexuality within families, Richard C. Pillard, a psychologist at Boston University, concluded that the brothers of gay men were five times more likely to be gay than the brothers of heterosexual men. In 1991, Pillard and Michael J. Bailey of Chicago's Northwestern University published a report, only a few months after LeVay's, called the "Genetic Study of Male Sexual Orientation" in which they studied male twins, at least one of whom was gay. They found that if one twin is gay, then an identical twin is three times more likely to be gay than a fraternal one. In 52 per cent of the cases the identical twin was also gay while the figure was 22 per cent for a non-identical twin. Because identical twins share the same genes, Pillard and Bailey argue that their study suggests a genetic influence on homosexuality.

Their conclusions have been inverted by critics who ask, if genes play such a large role, what of the 48 per cent of identical twins studied that are discordant – where one is heterosexual? A large percentage, given that they share each others genes and usually share a similar upbringing. The other major criticism is that they did not study twins raised apart.

In July 1993, Dr Dean Hamer of the National Cancer Institute in Washington published a report in *Science* magazine which pointed to a possible site for a gene which plays a part in homosexual orientation. Hamer and his researchers initially studied 76 homosexual men and determined which other members of their families were gay. They found that 13.5 per cent of brothers of homosexual men were also gay – a much larger percentage than Hamer's base rate of 2 per cent for homosexuality in the general population. The research found that there were more gay relatives on the maternal side and this sent Hamer looking to the X-chromosome – the only one passed on exclusively from the mother – as the possible site for the gay gene. Hamer

then studied 40 pairs of homosexual brothers and analysed genetic linkage to search for genetic markers held in common. Thirty-three pairs of brothers shared a set of markers located somewhere on the 8th region of the second band of the long arm of the X-chromosome – Xq28. Hamer concluded that it is this area – which contains hundreds of genes – that is the site of the gene which predisposes homosexuality in males.

There were also criticisms of this report. It was argued that Hamer didn't check for the marker in the heterosexual brothers in the families studied and that, while each set of twins shared a specific DNA sequence, there was no sequence shared by all sets of twins. Many believe that the announcement was premature as the study had not been replicated and genetics is littered with examples of the 'discovery' of a gene, such as those for alcoholism and schizophrenia, which failed future examination.

The major criticism levelled at all of these studies is that to search for a correlation between a single gene and complex behaviour such as sexuality is naive and ignores complexity and interaction. Behaviour is due to many factors, biological and environmental. Traits are usually influenced by a multiplicity of genes that interact in a number of places. A person's genetic make-up may play a big part in the way they act but the environment in which they act and individual experience will also affect how genetic pre-disposition develops.

Another criticism of the above studies is that none of them studied lesbians – dead or alive. Lesbian critics have argued that this mirrors lesbian invisibility in wider society. Hamer is at the moment undertaking research to find the genetic marker in lesbians while Bailey and Pillard are about to publish some results from their study into the heritable factors in female sexual orientation.

# Dark Matter

Desperately Seeking Machos

by Paul Davies

The ultimate fate of the universe hangs on MACHOs, WIMPs and neutrinos – and maybe even photinos, gravitinos and axions. Just how much of this elusive 'dark matter' there is lurking in the cold depths of space has astronomers scratching their heads.

**Evidence has accumulated that dark matter dominates the universe**

For centuries astronomers gazed at the bright objects in the sky and supposed they were studying the stuff of the universe. It came as a shock when they discovered that ordinary stars constitute just a tiny fraction of the total cosmic material. Embarrassingly, astronomers can't see most of the matter in the universe – as much as 90 per cent – and they still have scant idea just what this unseen stuff might be.

Ordinary telescopes reveal only the objects that shine. Along with stars, this includes clouds of glowing gas and dust that may appear in silhouette against a bright background. But there could be many objects in space that are too dark to detect, or are simply invisible. Recently, evidence has accumulated that this so-called dark matter does, in fact, dominate the universe.

Although dark matter can't be seen directly, it can betray itself through gravitational effects. By observing how bright stars move, astronomers can spot tell-tale signs that show if these stars are being tugged by the gravity of unseen matter.

The stars in our galaxy, the Milky Way, move in a mysterious fashion. On the face of it, those near the edge of the galaxy should orbit much more slowly than those near the centre, where most of the material seems to be concentrated. This arrangement is familiar to our solar system, where the usually outermost planet, Pluto, orbits the sun at one-tenth the speed of the innermost, Mercury.

By contrast, stars near the edge of the galaxy move almost as fast as those close to the galactic nucleus. Without a lot of additional matter pulling on them, these peripheral stars would be flung off the galaxy like an exploding flywheel.

Astronomers conclude that the Milky Way is embedded in a huge halo of dark matter that may contain more mass than all the luminous objects put together. Similar conclusions apply to other galaxies. The spaces between galaxies seem to contain dark matter too, evidenced by

the fact that galaxies in tight clusters also move too fast to be bound together by the gravity of the luminous material alone.

Estimates of how much dark matter there may be vary widely. Some theories about the origin of the universe imply that as much as 99 per cent of the universe has been so far undetectable. A figure of at least 90 per cent seems probable.

What can the dark matter be? There are no lack of candidates, varying from invisible subatomic particles to massive cosmic strings a billion light - years in length. Astronomers divide the two competing theoretical objects into two broad classes, which may, not accidentally, be called MACHOs and WIMPs.

MACHO stands for Massive Compact Halo Object, with black holes being a favoured example. They can lurk unseen in space and possess masses ranging from the equivalent of an asteroid to a million stars or more. More mundanely, there could be vast numbers of MACHOs in the form of small, very dim stars or large planetary bodies that would not show up in a telescope.

Last year astronomers at Mount Stromlo in New South Wales claimed to have spotted a MACHO – most likely a dwarf star – in the halo of our galaxy, using an indirect technique known as gravitational lensing. If an unseen MACHO by chance interposes itself precisely on our line of sight to a more distant star, then the star will appear to flare up in brightness for a few days. The effect, first predicted by Albert Einstein in the 1930s, occurs because the gravity of the MACHO bends the star's light and focuses it, much like a lens. By carefully monitoring a million stars in the Large Magellanic Cloud – a 'satellite galaxy' of the Milky Way – the Mount Stromlo team were able to detect such an event.

More exotic dark matter possibilities come from subatomic particle physics. The Big Bang in which the universe originated must have created many particles in addition to

the familiar electrons and protons that go to make up ordinary matter. Although most of these primordial particles rapidly decayed, some undoubtedly persist.

The best-known example is the neutrino. Discovered in the 1950s, neutrinos are emitted in copious quantities in nuclear reactions such as occur at the heart of suns. However, they interact so weakly with ordinary matter that most of them pass straight through the Earth with scarcely a shudder. Cosmologists believe the Big Bang created a billion neutrinos for every atom existent today. If so, the universe is in reality a vast sea of neutrinos within which we and all the stars we can see are but tiny impurities. It is an arresting thought that every second, without our feeling a thing, our bodies are penetrated by a thousand trillion such cosmic neutrinos.

Because neutrinos go straight through us, we don't notice them; they are completely invisible and produce few physical effects. The cosmic neutrino sea thus forms a sort of shadow that exists all around us. However, these ghostly particles still exert a gravitational pull, and if they had enough mass, neutrinos could account for much of the dark matter in the universe. Unfortunately, direct measurement of neutrino mass gives too low a figure to support this explanation. Moreover, most neutrinos are travelling too fast to become trapped in galactic halos anyway. So there has to be something else.

Fashionable theories of particle physics predict several hypothetical particles with mass greater than the neutrino which, individually or collectively, could fit the bill. They carry cryptic names like 'photino', 'gravitino' and 'axion'. These are the so-called WIMPs, or Weakly Interacting Massive Particles.

Ambitious schemes are afoot to try and detect WIMPs directly. If they exist as primordial relics of the Big Bang, then the Earth must be continually sweeping through swarms of these minute entities.

**If there is as much dark matter as some astronomers think, then**

Although WIMPs interact with ordinary matter only very weakly, it is possible they may nevertheless produce noticeable effects.

Calculations suggest that if a WIMP travelling at high speed hits the nucleus of an atom head on, it may interact strongly enough to produce a measurable recoil. To record the impact, physicists plan to use as a target an ultra-pure crystal of germanium, cooled to within a whisker of absolute zero.

Incredibly, the WIMP will be revealed by the sound it makes when it strikes a nucleus. Enough energy can be delivered to set the crystal ringing, enabling the experimenters to pick up the impact acoustically, or else to measure the tiny rise in temperature as the sound waves decay into heat.

To avoid the cacophonous clamour of more conspicuous particles, such as cosmic rays, the scientists have to retreat deep underground with their detectors, locating the apparatus beneath a mountain or inside a mine. Experiments to hunt for WIMPs are already well advanced in both the United States and Great Britain. Although it may appear bizarre to search for the stuff of the cosmos several kilometres under the ground, these experiments offer the best hope of settling the controversy of dark matter.

While the search continues for both MACHOs and WIMPs, cosmologists are busy trying to weigh the universe as a whole. There are roughly  $10^{50}$  tonnes of visible matter out there. In total that adds up to an enormous gravitational pull, but a simple sum shows it to be inadequate to arrest the expansion of the universe and turn it into a contraction. If there were no dark matter the universe would be destined to expand forever.

If dark matter outweighs the stars by a hundred to one, however, then the universe will be trapped by its own gravitation, and will one day start to contract. This will happen slowly at first, but at a gathering pace, it will collapse inwards and obliterate itself in a Big Crunch – the Big Bang in reverse.

For 60 years cosmologists have known that the ultimate fate of the universe hinges on the total amount of matter it contains, but ignorance of dark matter led to a general assumption that the cosmos would endure forever.

If it turns out there is as much dark matter as some astronomers think, then it is clear the universe is doomed.


Artwork by Jon Lomberg



An artist's representation of our solar system entering a cloud of dark matter. The gravitational influence of the dark matter is seen disturbing the orbits of comets located in the Oort cloud which surrounds the solar system, causing some of them to fall in toward the Sun

the universe is doomed





# Rattling The Cosmic Cage

by David Blair

Constant but undetectable ripples shimmer through the universe, passing through the Earth and gently jostling all matter. Detecting these elusive intergalactic eddies – gravity waves – could spawn a new technological revolution.

The Perth Niobé Antenna, at the University of Western Australia, is a 1.5 tonne bar of superconducting niobium, a metal with special properties. Acting as a bell, the Perth antenna has the lowest acoustic losses ever observed in a metal, ringing for days after it has been struck. This gives the antenna an extra sensitivity margin compared with existing antennas made of aluminium, without the need for ultracryogenic operation

## Space is not just void and emptiness, something reached in a rocket. It surrounds us and is part of us.

After 20 years of intense experimental and theoretical effort, astrophysicists are finally on the verge of a daunting feat: detecting gravitational wave vibrations produced whenever black holes and neutron stars form in our corner of the universe.

The technical requirements of this task are staggering. Scientists have to build detectors capable of measuring a ripple as subtle as the vibration of an atom occurring between the Earth and the Moon. It is only recently that technology has reached a level where observing such waves is not only a possibility, but close to reality.

Gravity waves are ripples of space: from their faint vibrations, astrophysicists eventually expect to create images of the final moments of the formation of black holes, and even the earliest moments of the Big Bang – when gravity shook itself free from the other forces of nature.

Space is not just void and emptiness, something reached in a rocket. It is around us and part of us. The universe is made of it, and it is filled up with various bits and pieces – atoms and stars and galaxies and light. But what, exactly, is it? Because it cannot be touched, because it is beyond tactile reach, space might be called “nothing” – an emptiness between objects. But space, combined with time, has four dimensions.

One could picture space as a grid of imaginary lines, like lines of longitude and latitude on two-dimensional maps of Earth. The lines are useful for measuring the Earth, but they don’t tell us what space is.

So what is space? Nobody really knows. Some of its properties are known. Its shape can be measured, and we know that it is flexible – although it is incredibly stiff. In fact, space is the stiffest stuff in the universe, far stiffer than diamond, the hardest material known on Earth. Yet today we know how to listen to it, because, like a drum or a metal gong, it vibrates. It is also known that holes can be wrenched in the fabric of space, and it appears that these holes – black holes – are relatively common.

In the last two decades, incredibly precise experiments – in laboratories, spacecraft, and in the observation of far-away star systems – have tested the innumerable ways that space-time can bend and distort. Albert Einstein’s original theories on gravity have been proved, but one enormous gap remains – the detection of a gravity wave.

Roughly 130 years ago, Scottish physicist James Clerk Maxwell developed a theory of electromagnetism. Many wondered what these waves were: could they be created in the laboratory? Could they be detected? It took until the 1880s for Heinrich Hertz to actually detect the waves Maxwell had predicted, and the discovery set the course for the electronic revolution which gave us radios, television, computers and the like. It’s not impossible to suppose that when we actually detect and image gravity waves – opening a totally new window into nature – it will spark yet another technological revolution.

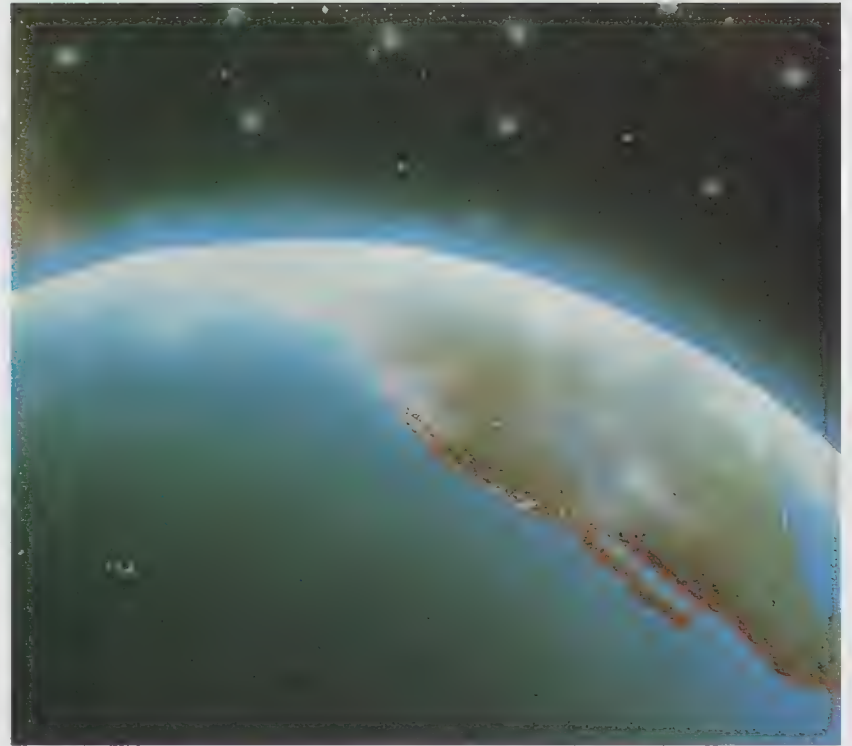


Illustration by Jon Lomberg

Einstein predicted that space was always bent and distorted by matter, and showed that gravity could be entirely explained by the curving of space. And, just as Maxwell’s theory predicted electromagnetic waves, Einstein predicted gravity waves.

Making the fabric of space vibrate is not so simple. Space can’t be hit with a stick like the canvas of a drum: but mass can bend the skin of the drum. So change the mass distribution suddenly, and the drum skin will suddenly bend. One example is a supernova, an explosion of a star and the sudden collapse of its core, which can create a black hole or neutron star, sending out shock waves more powerful than all of the world’s atomic bombs going off at once. At other times, pairs of neutron stars can spiral together and coalesce to make a black hole, creating similar disturbances in space.

How often the vibrations of the drums of space reach Earth depends on the signal strength. In Earth’s galactic backyard, the Milky Way, any of these events will create strong signals because they are close – only 30,000 light years away. That’s pretty far in our terms, but only across the street in comparison with the immense size of the universe.

Current gravity wave detectors are sensitive enough to detect waves originating in our galaxy, but even the greatest of optimists do not expect much more than one such event per decade. But if instruments are built to listen for events 1,000 times softer, the horizon will be stretched to encompass thousands of galaxies, and therefore increase the chances of detection by similar orders of magnitude. This increases the potential frequency from one event every 10 years to more than 100 events a year. At this level even the pessimists would expect a few per year. Stretch the



sensitivity another 100 times and the number of galaxies increases one million-fold. At this sensitivity stars could be heard exploding once a second, and space would be constantly rippling and chirping, like the sound of cicadas on a summer evening.

Because of the extraordinary stiffness of space, detecting these waves is one of the most difficult challenges ever faced by science. A wave in a stiff medium has small amplitude, even if it has plenty of energy. Imagine hitting a solid block of rock with a sledgehammer – you may put lots of energy into it, but the result is quite small.

Enormous amounts of gravitational wave energy are expected to be flowing around the universe. Space should be constantly vibrating as black holes form and neutron stars collide. Echoes from the Big Bang itself, when the universe was created some 15 billion years ago, should still be expanding outwards, leaving space murmuring continuously like the sounds in a seashell. The pattern of these waves, when detected, will allow an image of the very moment of creation.

It may one day allow researchers to locate where in space the universe was created, in effect the ground zero of Creation.

The technology for gravitational astronomy has been developed in a painstaking struggle over the last two decades. No-one foresaw the extraordinary difficulty of this task. I recall arriving at Louisiana State University in March 1972 and noticing in the basement signs saying "GRD for Xmas". I took note of the project goal: to have the gravity wave detector running by the end of the year. When November came, my wife said: "Let's go to Mexico for Christmas", and I replied: "Impossible. We are supposed to have gravitational radiation detection by Christmas." I later checked



Top: Artist's impression of Gravity Wave movement through space and around Earth.  
 Above: As a supernova explodes the energy created spreads debris and radiates gravity waves into space.

## Gravity waves are waves of tidal force... They cause objects to distort

with the leader of the team and he smiled: "Oh, don't worry about those signs. They were put up for last Christmas."

Since then I have applied the experimentalists' time law, which states: "When an experimental physicist tells you how long a project will take, take his estimate, multiply by pi and change to the next highest units. That is, one day becomes three weeks and six months becomes 18 years." Gravity wave detectors show a surprising fit to this law. Many years have passed since the initial optimism of the experimental physicists, and we are at last on the threshold; the technology needed to detect gravity waves, either existing or within our reach, can now be identified. While reaching this level of sensitivity is still far away, it is now within contemplation.

There are two basic approaches to detection. The first consists of detecting the ringing induced in a bell or some other resonant mass. In practice, big bars or spheres or disks weighing many tonnes can be used. These must be cooled to the lowest possible temperatures to allow superconducting vibration sensors to pick up the infinitesimal beat of the gravity wave over and above natural background vibrations. Enormous precautions must be taken to cut out the natural seismic quakes which are typically one billion times larger than the expected signal.

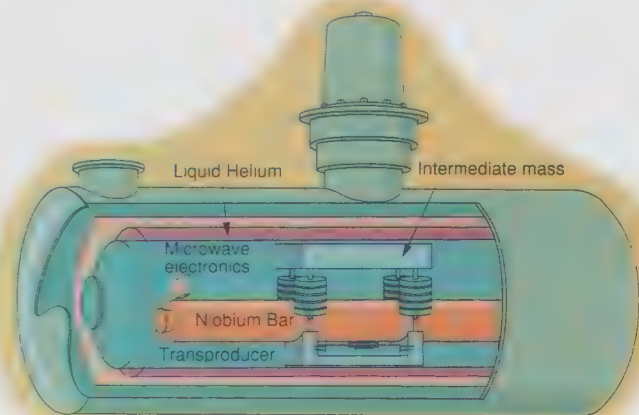
In 1994, for the first time, three of these resonant mass detectors began operating simultaneously. The Louisiana group, led by Bill Hamilton, have had their antenna, Allegro, operating alone for several years, but has been unable to distinguish between possible signals and local disturbances. In 1993 the Australian antenna, Niobé in Perth, came into operation, and finally Explorer in Rome came on the air in January this year.

The worldwide spacing of antennas is a key to gravitational wave astronomy. A gravity wave should take 40 milliseconds to pass through the Earth. Earthquakes and other disturbances are much slower. Careful timing of signals therefore allows you to triangulate to determine the direction of the signal, while rejecting local disturbances. It also enormously enhances the chances of being able to separate gravitational waves from other cosmic or Earthly noise.

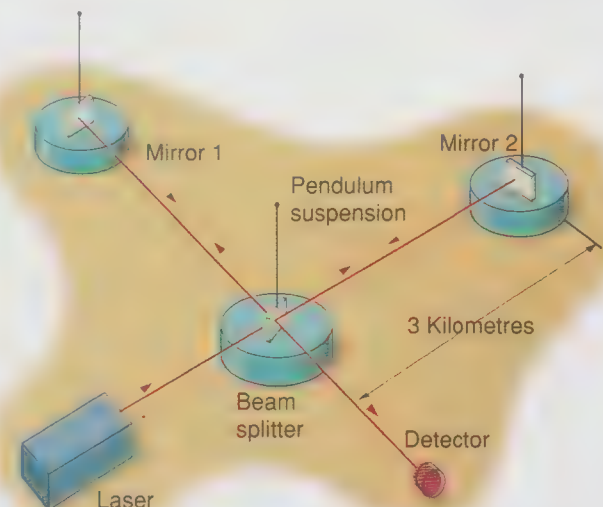
The resonant bar detectors now operating are sensitive enough to see the rare gravitational wave bursts expected from black hole and neutron star formation in our galaxy. However, the rareness of these strong signals from nearby sources would require monitoring over decades. The cryogenic resonant bar detectors, being reliable and stable, are ideal for this purpose. The currently operating detectors are cooled to the boiling point of liquid helium – four degrees above absolute zero, or  $-269^{\circ}\text{C}$ .

Improved detectors are under development to operate at temperatures at least 40 times colder than this, less than 100 millidegrees above absolute zero. The Rome group, led by Professor Guido Pizzella, has successfully demonstrated such extreme cooling of a big aluminium bar, but it will be several years before this new generation of detectors comes into operation. When it does, the sensitivity should improve roughly by the cooling factor of 40, because thermal noise, directly proportional to temperature, is the primary factor limiting sensitivity. Plans for detectors 10 times more massive than existing ones, weighing 30 tonnes or more, are

A resonant mass gravity wave bar detector is made up of a carefully suspended mass, cooled to the lowest possible temperatures to reduce internal vibration, and a super-sensitive vibration sensor



A laser interferometer detector consists of supersensitive mirrors suspended by vibration isolators, a beam splitter and an extremely accurate light detector. An instrument of this configuration would be well matched to the requirements of detecting a gravity wave



## in the same way that the tides can distort the oceans of the Earth...

on drawing boards around the world. These would allow another 10-fold improvement in energy sensitivity. A 10-fold improvement in deformation sensitivity is equivalent to a 10-fold increase in the diameter of an optical telescope. In 20 years, resonant bar detectors have improved 100-fold in deformation sensitivity, equivalent to the step from a tiny 10 cm optical telescope to a giant 10 m optical telescope.

The step to the massive ultra-cryogenic detectors will be like another 100-fold size improvement for optical telescopes. But this is still not good enough. Nature is unkind and our galaxy is rather isolated in the colds of space. The distance from our galaxy to the nearest major cluster of galaxies, the Virgo cluster, is so vast that all of these improvements are barely enough to detect more frequent signals.

For further improvements, many physicists have chosen a completely different technology. Resonant mass detectors have one fundamental and practical limitation: they cannot be scaled up to an arbitrary large size, because – apart from enormous cost – their frequency is set by the velocity of sound in the material. It is better to have detectors that are kilometres long, because this size would better match the spacing between the crests of the gravity wave, which are expected to be hundreds of kilometres apart.

This can be achieved if, instead of using a detector which is coupled by sound, you use a detector coupled by light. This means using pairs of widely-spaced mirrors, and detecting the relative motion of these mirrors by a laser beam reflected between them. The best way of doing this is with a laser interferometer, two pairs of mirrors set up at right angles to each other.

Gravity waves are waves of tidal force. They cause objects to distort in the same way that the tides distort the oceans of the Earth: there is a high tide at opposing points, and a low tide between them. A laser interferometer splits a light beam at right angles and compares the path lengths in the two arms by the interference pattern when they recombine after travelling to the distant mirrors and back. Any changes in this spacing register as a change in light intensity at the output.

Even when the mirrors are several kilometres apart this method is capable of measuring changes of spacing of a billionth the size of an atom. The measurement to this precision is only possible if the mirrors reflect the laser beams back and forth many, many times. This sensitivity demand means that the mirrors must be more than 1,000 times better than the best telescope mirror: in reflectivity, in smoothness and in shape. The lasers must be super-efficient, super-stable and frighteningly powerful. The mirrors must be isolated against all terrestrial vibration to better than the billionth the size of an atom.

Four laser interferometer detectors on the surface of the Earth, with one essential southern hemisphere site, are needed to create a gravity wave telescope. In the United States, the LIGO project is constructing two detectors of 4 km in length. Another 3 km instrument, called VIRGO and jointly funded by France and Italy, is to be constructed at Pisa, Italy – not in itself a bad site for gravity experiments, considering its famous leaning

tower. Germany, with British collaboration, and Japan are building smaller scale instruments. In Australia, a consortium of research institutions combined with India and Argentina, propose to build the southern hemisphere arm in the worldwide telescope. On current plans, these new detectors should start to operate by the turn of the century.

Scientists aren't fooling themselves – they know that the technological demands of gravity wave detectors are staggering. But in building the existing detectors, gravity wave physicists have made major advances: they can now routinely measure vibrations equivalent to about one-tenth of a millimetre in the distance from here to the nearest star, Alpha Centauri, some 4.3 light years away. This is equivalent to measuring vibrations the size of an atom occurring between the Earth and the Moon. The new detectors will be even more powerful – able to measure a ripple in space the size of about one atom vibrating between the Earth and Alpha Centauri.

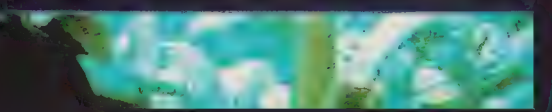
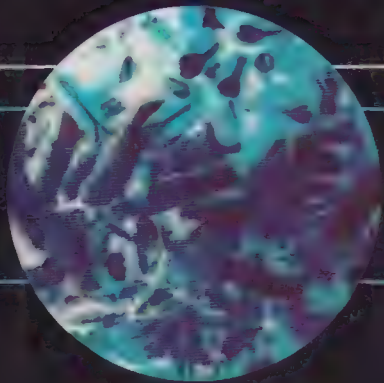
Such enormous leaps in technology will have benefits far beyond the fundamental science which is the driving force for their development. New detectors will require the largest vacuum systems ever created; a new generation of lasers that must be among the most efficient light sources ever created, and will have enormous impact on all sorts of unrelated fields from forensic science to welding and cutting. However, they will be so powerful that some controls on their use may be needed – their potential mis-application, by the military or terrorists, would have awesome implications.

To be able to listen to the birth of the universe itself, and to the death of stars as they disappear from the visible universe, is startling enough. But the research also promises technological and economic benefits to people on Earth. Gravitational waves are a completely new spectrum, a totally new window onto the universe, and to explore them will require new technology, new ideas and new devices. Research to date has already spawned new time standards, new magnetic sensors, ultrasensitive vibration sensors, devices for mineral exploration, magnetic brain activity monitors, and improved radars. The new gravity observatories on the drawing boards will also require new lasers, new vacuum techniques, new optical systems, and new vibration isolation techniques – all of which will be useful in extending our knowledge in other fields.

One hundred years ago Hertz pioneered the search for electromagnetic waves, never guessing it would yield the electronic revolution of the 20th century. We have no idea what the search for gravity waves will lead to, but there is no doubt that we will benefit from the challenge and the innovation it requires.

We do not know where gravitational wave astronomy will take us. We know that it is the only way of probing the earliest moments of the Big Bang and of imaging black holes as they shimmer in the gravitational waves of their birth. It may seem unlikely that gravity wave technology will lead to a new revolution like the electromagnetic revolution. But then, Hertz could not have predicted television, and like the exploration of all new frontiers, we can be certain that there will be surprises. ■

# Aliens in the abyss





by Tim Thwaites

**Monsters from the deep or alien life-forms  
living secretly beneath our oceans?  
Even the scientists are confused.**

The ship swoops low and hovers over the dark surface of volcanic rock. It is the only source of light in a totally black world.

The voyage from the mother vessel has taken more than an hour-and-a-half of slow descent, but the three men cramped on board have not yet reached their destination. It takes them several hours more, floating almost silently above the dark, craggy landscape.

Suddenly, as if out of nowhere, there it is, like an oasis in the desert. The view is spectacular, breathtaking – a waving forest of bright red and white worms. Anchored to the seabed, some are more than a metre-and-a-half in length and five centimetres in diameter, and they are crawling with large crabs. Bright red crayfish and shrimps move through them, together with pinkish fish and octopi. White clams and brown orange mussels and snails can be seen. There are even anemones, tentacles waving.

This is no science fiction voyage to another planet, but a relatively routine visit in a submersible to Earth's most alien environment – the volcanic vents on the deep-sea floor, about two thousand metres below the surface.

Here live the only known life forms on Earth which do not depend ultimately on energy from the sun for their existence. Instead, they thrive on heat from the Earth's core. And that energy source supports crowded and diverse communities of bacteria and animals which are so ancient, they may be where life on Earth originated, according to Associate Professor Horst Felbeck, of the Scripps Institution of Oceanography in San Diego, California.

Even if deep sea vents are not where life began, they could well be where it persists, says Felbeck who has been studying these strange life forms ever since they were first discovered on the floor of the eastern Pacific by a French-American team in 1979.

"These animals will survive a long time after [life on] the surface of the

Earth is dead. The only input they need is oxygen. They are provided with their own energy source until the Earth goes cold."

While almost all these deep sea creatures are easily recognisable as related to animals living in much shallower water, their lifestyle is different enough for distinguished science fiction writer Arthur C. Clarke to use them in his novel *2010: Odyssey Two* as his model for life on Europa, one of the moons of Jupiter. The US National Aeronautics and Space Administration has been sufficiently interested in them to finance a post-graduate student to work in Felbeck's laboratory.

According to current geological thinking, the solid, rocky outer coat of the Earth floats on a bed of molten rock or magma. This outer coat or lithosphere – which forms the land on which we live and the floor of the sea – is believed to be made up of a series of jostling plates, some the size of whole continents. These plates move relative to each other and scrape together like the pieces of an ill-fitting jigsaw puzzle.

The lithosphere is thought to be formed and destroyed continually by the magma underneath. At some places, notably in the middle of the oceans, new material wells up and forms ridges which spread the seafloor, and extend the plates away from the ridge line in both directions. Along the continental margins, where two plates collide, one rides up over the other, and material from the lower plate is absorbed back into the magma below forming the ocean trenches. Both these actions are accompanied by volcanic activity which can tear the lithosphere fabric apart and expose the molten rock beneath.

On land, one consequence of this geological activity is the formation of hot springs and geysers, such as those found at Rotorua in New Zealand and Yellowstone National Park in Wyoming.

Under the ocean, these springs take the form of hydrothermal vents. From them superheated water issues forth at temperatures which can be

as high as 350 or 400 degrees Celsius. The water does not boil because the pressure two kilometres below sea level is about 200 times atmospheric pressure.

When the natural sulphates in sea water come into contact with hot rock at this pressure, they lose oxygen and become sulphides. The superheated water which emerges from the vents carries dissolved in it compounds of these sulphides and the minerals, which have been leached from the rock the water has passed through. But as soon as the hot water comes into contact with the cold sea water, it cools rapidly and the black mineral sulphides immediately fall out of solution. The effect is to produce what are known as “black smokers”, which mark out active hydrothermal vents. They were first discovered by the 1979 expedition in which the Scripps Institution played a major role. The mineral grains in the “smoke” pile up on

are exploiting the sulphides of hydrothermal vents. Sulphur bacteria also occur in many other places on Earth – just about anywhere, in fact, where rotten egg gas (hydrogen sulphide) is a natural part of the environment. These include places such as hot springs, intertidal flats, sewage outfalls and mangrove swamps. But the deep sea is the only dark environment in which they are found, and the only environment where they are the sole provider of energy to other organisms.

In all other places on Earth, animals depend for their energy on eating or breaking down plants or other animals. The sugars made by plants ultimately provide the energy source for all other organisms. In the same way, free-living sulphur bacteria near vents can be digested by other organisms to provide energy. But Horst Felbeck and his colleagues have found that some deep sea sulphur bacteria are party to a remark-

of life on Earth. This may come as no surprise to a group of researchers who believe there is good evidence for speculating that life itself began at the deep ocean hydrothermal vents. All the ingredients are on hand – water, carbon dioxide, minerals and energy – to form the complex carbon-based chemicals of living organisms, says Felbeck. And there is a bonus. Because sunlight cannot penetrate to such depths, any complex chemicals which might form would be protected from destructive ultra-violet radiation.

Whatever the case the organisms that crowd round the vents, although strange by virtue of their adaptation to the extreme physical conditions and odd patterns of nutrition, are clearly related to other life forms on Earth. They are recognisable as crabs, mussels and clams, albeit rather different ones.

“They are biochemically normal, they just

## About 95 per cent of the animals found around the vents are new species. Some marine biologists claim

the bottom to form chimneys over the vents – black hollow mounds which can grow as high as 20 to 30 metres before they eventually topple over. The chimneys remain active only for a limited period of time. As the plates move vents close in one place and open up in another.

The sulphurous mineral material from which the chimneys form is very rich in base metals – copper, silver, zinc and gold at the margins of the continents where plates collide, and iron at the mid-ocean ridges. In fact, the deep sea deposits are thought to be the ultimate source of base metal deposits mined on land, such as at Broken Hill in south-western New South Wales. So researchers from the CSIRO Division of Exploration and Mining are examining deep sea mineral deposits off the coast of Papua New Guinea for clues as to where similar desposits might be found on land (See BEYOND section).

They have discovered that chimneys near active vents are crawling with life. And that life depends ultimately on the ability of bacteria to extract energy from sulphides by combining them with oxygen to form sulphates.

Just as plants use the energy of sunlight to force carbon dioxide from the atmosphere to combine with water to form energy-rich sugars, so these bacteria use the energy they extract from sulphides to power a similar chemical reaction involving the carbon dioxide dissolved in sea water.

It is not altogether surprising that bacteria

able way of passing the energy they extract to tube worms – an interaction from which both organisms gain.

Tube worms have no proper digestive tract – they have no mouth, no gut, no anus. Even stranger, tube worm cells are packed with sulphur bacteria. In fact, the bacteria make organic material right inside the animal, in a protected, predictable environment.

Although the bacteria can be digested by the tube worm, this does not happen frequently, only when a bacterium dies. The living bacteria are much more useful. They excrete organic material in the form of succinic acid (which is a breakdown product of glucose). This can be used directly by the tube worm cells as a source of energy.

In multicellular organisms, the breakdown of sugars to release energy within cells is a highly controlled process. It takes place inside specialised packages of membranes within the cell, known as mitochondria. Mitochondria contain the enzymes which regulate the energy production process. They even have their own genetic material and can reproduce themselves inside the cells.

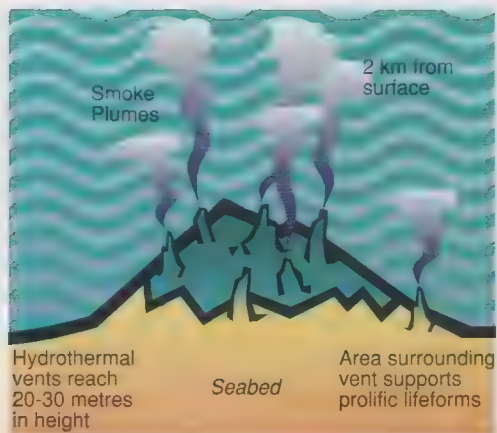
Many cellular biologists have argued that mitochondria may have started life as bacteria living inside cells, much as the sulphur bacteria in tube worm cells.

In fact, the symbiotic relationship between tube worms and sulphur bacteria is a curious parallel to what happened during the evolution

exploit a completely separate energy source,” says Felbeck. But, he says, about 95 per cent of the animals found around the vents are new species. There are also whole new families of animals, and some marine biologists claim that the tube worm is so different from any other known creature that it deserves a whole new phylum. This ranks it in significance alongside molluscs, mosses and animals with backbones.

Normal deep seabed creatures live in sparse populations, says Dr Buzz Wilson, senior research scientist at the Australian Museum in Sydney. Their only source of food is what rains down on them from above – bits of dead fish, the faecal pellets of crabs. And after drifting down through kilometres of water to get to the sea floor, even these meagre offerings have become highly modified.

To cope with such conditions, where the pickings are slim, deep sea animals remain small, grow slowly and live long, many of them for decades, Wilson says. They have special adaptations, such as sensitive bushy antennae, to help them find mates. In some species of crustaceans the females have the capacity to store sperm so that when they find a male, they can make the most of copulation, by hoarding the sperm for later use if their eggs are not ready for fertilisation. The young are often kept in a brood and released as young adults to settle relatively near to their parents.



1



3

1. Diagram of volcanic vents where the tubeworms thrive
2. Horst Felbeck of the Scripps Institution of Oceanography holds up a tubeworm which has been removed from its seafloor anchor.
3. Superheated water spews from hydrothermal vents on the seafloor, the region favoured by these bizarre new lifeforms. The forward section of the research submersible can be seen in the lower part of the picture.
4. A mechanical arm on the research submersible Alvin probes a nest of tubeworms 1.6 km below the ocean surface.

that the tube worm is so different from any other known creature that it deserves a whole new phylum.



2



4

By contrast, the hydrothermal vents are densely populated. "It's a very good economy for organisms," says Wilson. The problem is that it is a risky environment. A vent may only last for 10 years, or it may erupt, cooking its inhabitants. So vent creatures grow fast and generally end up large and mobile. Not a lot is

known of their reproduction, but the sedentary tube worms release sperm and eggs into the water, and there is a highly mobile larval stage.

Felbeck says the sulphur bacteria-tube worm interaction forms the basis for the nutrition of the vent communities, although free-living bacteria are eaten by filter feeders such as mussels and clams. If an animal dies, it is broken up and eaten by the crabs. Bits and pieces are dispersed in the process and picked up by filter feeders. Other animals in the community, such as the fish and octopi are predators.


In the darkness of the deep sea, two features of the vent animals are perhaps unexpected. Some of the animals are highly coloured, even though they are unable to be seen in the dark. The colours seem to be restricted to a range of reds, pinks, oranges and browns. Perhaps even more bizarre is that some of the fishes and

crabs actually have eyes.

The colours are easier to explain. Some are simply the orange, brown and black pigments of the minerals picked up in some way by the animals. The reds and pinks of the tube worms, the fish and the flesh of the clams stem from oxygen transporting haemoglobin, the compound that colours human blood. Shrimps naturally have red dyes in their skin.

As for the eyes, Felbeck thinks they may be used to detect bioluminescence – light produced by some of the organisms surrounding the vents.

Once a year, the Scripps Institution has been sending a vessel to study the animals of the abyss. It is equipped with a submersible and carrying aquaria on board in which deep sea temperatures and pressures can be reproduced. "This allows us to study and perform experiments with live animals," says Felbeck. "This year I hope to put tube worm sperm and eggs together and see what happens. I wish to raise baby tube worms. We know nothing about larval development."

He is also looking at whether, instead of atmospheric oxygen, the sulphur bacteria can use the oxygen from nitrates in the energy production process. If they can, then Earth's strangest collection of animals would be even less dependent on the surface than is believed at present. And that would make it an even better candidate for life in the ocean depths of Jupiter's moon, Europa. 



# Beleaguered Nations

by David Lange

Bloated by administrators, racked by indecisiveness and dictated by superpowers, the United Nations remains undemocratic, undisciplined and seemingly unrepentant despite the end of the Cold War, argues the former Prime Minister of New Zealand.



Sunset on the U.N. blue helmet  
Austral

For two years, a tragedy has been taking place in the crumbling former Yugoslav republic of Bosnia-Herzegovina. Yet, a United Nations which was prepared to rescue the oil wealth of an aristocracy in the Persian Gulf is unwilling to defend a besieged and out-gunned democracy in the Balkans from what amounts to state-sponsored genocide.

During this time the West has been mouthing platitudes about the carnage, seen nightly on phosphorescent television screens around the world, while on the ground, Serbian shells have been maiming and killing Muslim villagers, and Serbian tanks have been advancing deeper and deeper into Bosnian territory.

What has become of the call for action by the Europeans and Americans to secure the safety of the thousands of Muslims in the "safe areas" of Gorazde? The U.N. in Bosnia, which promised to defend civilian refugees in these areas it delineated, has in fact lured them into places where the Serbian troops can more efficiently facilitate genocide.

By international law and convention, the U.N. was entitled to defend the safe areas against military aggression. It didn't, although it told Bosnians it would, and because of this, thousands of Bosnian Muslims who took shelter in Gorazde have become victims in an obscene bloodbath.

The very lack of action has proven that the U.N. Security Council is bankrupt of purpose and incompetent in the execution of its indecision. It cries wolf and then lies down with the lambs. It has capitulated to the decision of the United States and European countries to let the Muslims in Gorazde be slaughtered.

What has happened in Bosnia is a powerful message to the world that countries which don't have oil, don't block an international trade route, or don't have nuclear secrets, hold no real interest for the Great Powers of the Western alliance.

The best thing that could have happened to the world – the end of the Cold War and the emancipation of Eastern Europe – has put the U.N. to the test. Until then, it had rather ineffectually preserved a peace brokered by the superpowers. But now the buck stops at U.N. Plaza in New York. The organisation established on lofty principles finds itself entirely dependent on shifting coalitions of powerful countries, which assess their commitment to international principles on the basis of national self-interest. It is now little more than an echo chamber for the will of the major powers.

Its plight today is the worse for the much more fraught international

environment brought on by the fragmentation of the former Soviet Union and the end of its direct sway over its old clients, and the creation of new states founded on the ethnicity of long-suppressed nationalism.

The U.N. charter provides a mechanism for the resolution of disputes by legal process and for the collective use of force to compel just outcomes. The General Assembly is the purest form of the hopes raised by the creation of the U.N. in 1945: it is a place where the votes of all nations – rich and poor, small and big, weak and strong – are accorded equal weight.

But it also has a Security Council, the powerful executive where the Five Permanent Members – basically a club of World War II's winners – have an undemocratic veto over the will of the whole world.

The Gulf War has proved to be not so much a straw in the wind of the New World Order as a total aberration. Kuwait was rescued in the name of the U.N., but its name was all this international body gave to an *ad hoc* military coalition dominated by the one remaining superpower.

The U.N. has no standing force. It has no command structure. Major powers will not allow the U.N. to command their forces other than in non-combatant peacekeeping operations. The U.N. is totally dependent on the support of major powers and the willingness of the international community to combine in order to repel force.

Flushed by the early successes in Cambodia and Somalia – which have themselves proved to be mirages – the U.N. has not yet learned

the issues of principle involved in the betrayal of those seeking haven in Gorazde, New Zealand, like Australia, has to look at itself as an integral part of the world community. Unless there is an international order which respects the integrity of nationhood, and our right to survive as a people, the world is unsafe for all of us.

What happened in the Gorazde safe area happened to all of us. We either believe in the indivisibility of international justice or we sell our dignity short by seeking the protection of an international heavyweight. In the long run, the latter version resembles more the symbiosis of prostitute and pimp.

This involves a price for small nations like Australia and New Zealand. It has not yet occurred to Wellington and Canberra how hypocritical it is to bask in the glory of the presidency of the U.N. Security Council, which both have held recently, while complaining about the price when deeds are needed to back up words. We have, in the interests of international order, to participate in the actions from which we will gain no immediate pay-off, save the prospect of our ultimate security. As it nears its 50th birthday, the U.N. is a crisis-ridden shambles. It accepts functions it cannot possibly perform, and can't fund them because it doesn't pursue its debtors. Its bureaucracy is bloated, overpaid, and more and more ill-suited to the roles it performs. Redundant staff in the economic and social areas whom the U.N. can't afford to pay off are assigned to peacekeeping work for which they have neither enthusiasm nor ability.

All of that could be put right by the U.N. itself if the will were there.

## More than 200,000 people have been killed, and the international community is

that it should not give its commitment where there is nothing to back it up. It sent peacekeeping forces to Bosnia in the belief that there was a peace to keep. It kept deploying them even where it was obvious that the peace was illusory. Worst of all, it proclaimed safe havens, and allowed people to flock to them, without being certain that it could honour them if its bluff was called. The U.N.'s failure to honour its commitment to the civilian population of Bosnia strikes at the heart of its founding mission.

Membership of the Security Council is now an embarrassment. Any international organisation which offers a haven without being certain that the haven can become reality is, to say the least, morally dubious. The offence is doubled by the Security Council prohibiting the supply of arms to the beleaguered Bosnian Muslims, rendering them defenceless, giving them a false hope of haven, and then, in what some have described as statesmanship, taken the soft option and backed out. Nobody should be in any doubt that both New Zealand and Australia are members of a body now deservedly held in contempt. The Serbs are not stupid. They have assessed the will of the U.N. and must have been buoyed by its absence. They have relied on the support of Russia, but even Moscow seems to have had enough and may no longer be their protector. The United States and the North Atlantic Treaty Organisation hold the key. In the end, it's up to them to decide how to deal with the Serbs. The final result may be a ground war in the small and fledgling nation of Bosnia.

New Zealand is also a small nation, a disposable nation. Even ignoring

The U.N. must accept that as presently constituted its Charter does not fit it to be guarantor of international security. The Security Council is currently the property of the Five Permanent Members, who also belong to the nuclear club.

Japan and Germany, although economically powerful and the biggest donors to the Gulf War, are not Permanent Members. For reasons of sentiment the United Kingdom is rewarded, as is France, for having been on the winning side of World War II, rather than for its pursuit of international community. The status of permanent membership should be revoked. Certainly its right of veto must go.

No country should be allowed membership of the U.N. which does not respect the jurisdiction of the World Court and accept its decisions. It should not be possible to walk away from the court, as did France when challenged over nuclear testing in the South Pacific, or the United States when Nicaragua took action against it and won.

Peacemaking and peacekeeping are now all about passing round the hat and the body bags. The U.N. must have a standing force at its disposal, and must establish an effective command structure. Its first aim must always be the peaceful settlement of disputes, and it must be able to call on its membership to provide non-combatant peacekeepers to oversee settlements. But if there is a breach of the U.N. "blue line" in any zone, then it must have the will to hit back, and to hit back so hard that no-one will dare to cross that line again.

The United States is now the world's only real superpower, but it cannot

## Help, Help, Rwanda

*The United Nations is in crisis. Even the U.N. Secretary-General, former Egyptian diplomat Boutros Boutros-Ghali, is despairing, as he recently revealed in a press conference to journalists covering U.N. affairs in New York. The following is an edited extract of his answers, which begin with comments on the horrors of Rwanda.*

I will try not to be emotional. Let us recognise that it is a failure, a failure not only of the United Nations but also of the international community. All of us are responsible for this failure, not only the Great Powers but also the African Powers, the non-governmental organisations and the whole international community.

It is genocide which has been committed. More than 200,000 people have been killed, and the international community is still discussing what ought to be done. I have tried – I was in contact with different heads of state and I begged them to send troops. I was in contact with different organisations and I tried my best to help them find a solution to the problem. Unfortunately, let me say with great humility, I failed. It is a scandal. I am the first one to say it and I am ready to repeat it.

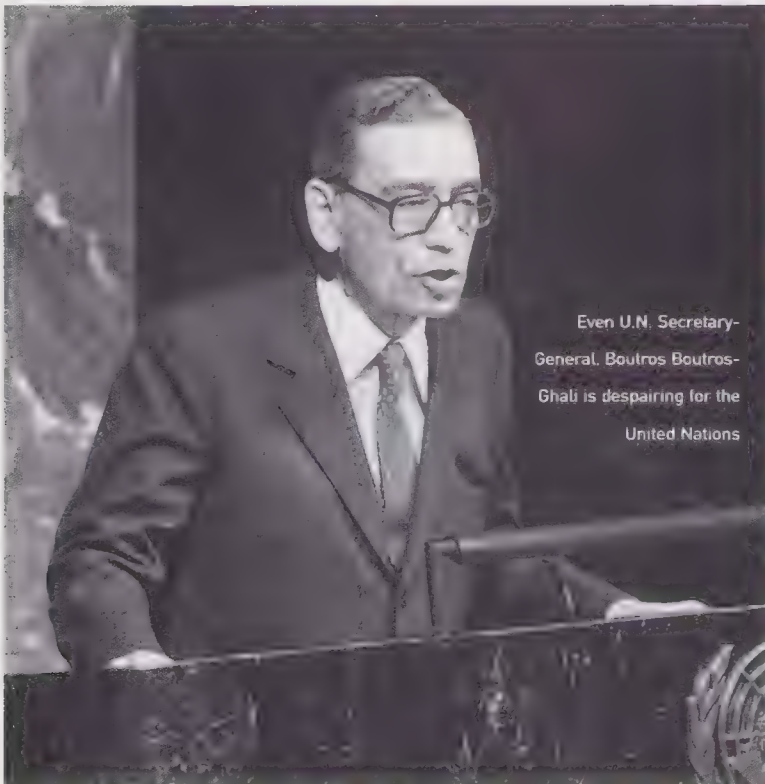
My role is to respect the decisions and resolutions of the Security Council. I can suggest different solutions, but the decisions are taken by the Security Council. It would be useless to say that I needed 20,000 troops, and to obtain a resolution from the Security Council for the 20,000 troops, if I were not able to find those 20,000 troops [from member states]. So let us be realistic; unless we have the support of member states, we will not be able to obtain the troops we need on the ground.

There is a fatigue in the member states. They used to get involved in two or three operations. Now we have 17 operations. The second explanation is a financial one. The member states and donor countries are in economic crisis and are less ready to participate in these operations, because they cost a lot. Public opinion is not helping the various governments and member states to participate in this kind of peace-keeping operation.

The end of the Cold War may be another explanation. As long as we had a Cold War, everybody was interested in what was going on somewhere in Cambodia, Angola or Mozambique. Now, the international community is less interested.

Thirdly, maybe we have not been successful in convincing the member states that what we are spending on peacekeeping operations today represents less than 0.1 per cent of what was spent by the international community during the Cold War, and that many of the confrontations going on – not all but many of them, such as those in Angola, Mozambique, Cambodia and El Salvador – are practically results of the Cold War. There are no arms factories in Somalia, in Cambodia or El Salvador. All those arms are the result of the Cold War.

So we have a kind of special moral responsibility to continue to do whatever ought to be done to help to solve all those disputes peacefully.



## still discussing what ought to be done

afford to provide the world's police force, and nobody should expect it to. It cannot be a disinterested enforcer of international justice, given that it is a democracy whose government is accountable to the domestic agenda of its electorate.

The U.N. must also establish its own intelligence network so that it can make sensible assessments of risk and not be entirely dependent on reports from members, reports which can be biased to promote the agenda of the member nation offering it.

Such advocacy has in the past been regarded, even by supporters of the U.N., as romantic rather than realistic. Fundamental reform of the U.N. Charter would involve an enormous enhancement of the security of small nations but also a diminution of the sovereignty of the Great Powers.

There is hope. The European Union, for example, has diminished the sovereign sway of each of its member nations in favour of a collective approach.

Appalling as they are, the tragedies of Somalia, Rwanda and Bosnia, and the prospect of more arising from the swirling currents of revived nationalism worldwide, may prove the stimulus for a rational and dispassionate decision by the Great Powers to trade off a part of their sovereignty in return for a real form of international security. This was the dream splendid which was shattered before the U.N. was hardly born.

It's time for the descendants of the dreamers who brought the U.N. to being, to have another go.

by Michael Perry

In a region where women are treated as objects to be sold and where past sex convictions of accused rapists are inadmissible as court evidence, feminism has a hard time making an impact.

## Grass Skirts



## Burning Bras

"If you relax by kicking your wife around, then do it."

Now there's a quote you don't expect to hear nowadays. Especially not from your Prime Minister. But that's what Fijian women have had to contend with, and although Sitiveni Rabuka later apologised – dismissing it as a joke he was having with a male Fijian journalist following his election victory press conference – it is indicative of the problems faced by women of the South Pacific. If nothing else, it reflects the low status of women living on the thousands of islands scattered across the region.

Rabuka's comment ignited a firestorm of feminist outrage across the South Pacific, but it received little sympathy from the general populace. On Fiji's main island of Viti Levu, only a small band of 30 women gathered on Ratu Sukuna Park in the capital, Suva, in March for a candle-lit service celebrating International Women's Day. It was a rainy, windy South Pacific night and the Fijian women struggled to keep their candles alight. Like the candles, feminism in the South Pacific is struggling to stay alight.

"There was obvious righteous and justified outrage at what he said," says Imrana Jalal, spokeswoman for the Fiji Women's Rights Movement. "But it reflects a very mainstream attitude towards women in Fiji and the Pacific.

"We have worked jolly hard since 1984 to really bring the issue of [domestic] violence on to the national agenda... to get people to recognise it as a crime. But if the prime minister says on television that he doesn't care if people kick their wives around, he is saying it is okay for people to commit a crime," she says.

Change is slowly coming to the South Pacific. Fiji, centre of Pacific feminism, is the first island nation in the region to establish a Ministry of Women. It's nothing grand: the offices are tucked away above a bric-a-brac shop in a back street of central Suva, unlike more high profile ministries with bigger budgets. But it is a step forward.

Female role models are also emerging. In Fiji's February election, a record 10 women were among the 192 candidates who stood for office. Three made it into parliament and two joined Rabuka's cabinet. Earlier this year, Fiji's Education Minister Maraia Taufa Vakatale was the country's first female acting prime minister while Rabuka visited the United States for two weeks. Vakatale, 56, is a former teacher and public servant and is one of the women in Rabuka's cabinet.

The irony is that, even in the region's matrilineal societies, women rarely appear in executive government positions.

"There is not one matrilineal society that I came across where women actually exercise power," says Jalal, a solicitor who spent a year and a half

studying law and women's rights in the South Pacific. "There are... a handful of women who, because of their chiefly status, have successfully made the transition from traditional power to Westminster-style power. It's one thing to be a conduit of power, it's quite another thing to have the legitimate right to exercise power."

Apart from the rare case of a woman inheriting the status of a chief after all her male relatives die, Pacific women are regarded as second-class citizens. Life on many of the South Pacific's palm-fringed islands has changed little over the centuries. Most people live a near-subsistence existence from fishing and farming in villages run by hereditary male chiefs. Women may perform most of the work, yet custom in these traditional societies disenfranchises them from any real power.

On a small island in Micronesia, male chiefs only last year allowed girls to leave the island after eighth grade to pursue their high school studies. "It took a lot of lobbying with the chiefs but finally the girls can go off island to school," says Rosa Tacheliol at the Yap State Department of Education. Women in Micronesia need to be educated because their culture prevents men examining or taking care of relatives of the opposite sex. "We need to educate our daughters to help us in the health field," says Tacheliol.

But if education is a method of escaping or at least broadening a culture, many Pacific Island women will never have the chance to make changes. In Papua New Guinea, 75 per cent of women are illiterate and many have numeracy difficulties also. Women shoulder much of the burden of subsistence agriculture, as well as domestic duties, and are therefore not perceived by the male decision-makers as needing an education, say women social workers. "If you don't have a key to the door, are you going to get out of the door?" asks Lucy Yomil, a literacy and adult education worker in Goroka in the Eastern Highlands. "Through literacy and education you will get to know your way."

Cultural barriers across the Pacific have historically discriminated against women.

"The status of women in Fiji is related to culture, that is the overriding influence on everything," says Lilli King, vice-president of Fiji's National Council for Women. "This is a Melanesian society. It is a patriarchal system. From the family level to politics, men make the decisions, that is the biggest problem we face."

Even the decision of childbirth rests largely with men. "For men a large family is a sign of masculinity," says King. "If a woman doesn't want another child, she doesn't have any say. Many women have an injection

## The intrusion of satellite television into the country's remote mount

and never tell their husband.”

Sterilisation by injection is Fiji's main contraception, with Depo Provera the favoured drug, despite worldwide questions about its safety. This suggests the lack of recognition of women's right to safe contraception in Fiji, say women.

Because of their lowly status, women are often regarded by Pacific men as possessions. Domestic violence is endemic in many countries like Papua New Guinea and Fiji. In Papua New Guinea, where polygamy is common, a recent survey found 65 per cent of men thought it acceptable to use violence to control their wives. Wives, after all, cost many pigs or thousands of kina, or dollars, in 'bride-price'. Domestic violence in polygamous marriages has been indentified as the main cause of deaths and injuries among women in the country's Highlands region.

Highlands divisional police commander, Assistant Commissioner Ludwick Kembu, says domestic violence contributes to 95 per cent of all deaths among women in his region. According to police records held in the capital, Port Moresby, there were 600 murders nationwide in 1993, most related to domestic violence.

In Papua New Guinea's kinship-based societies, marriage is a contractual arrangement often between clans, and entails reciprocal rights and duties. Sometimes marriages are between previously warring tribes, and women are part of the peace settlement – forced to live in a previously hostile clan where they are discriminated against and subjected to violence. If a marital problem arises, the dispute is not confined to the husband and wife, but involves scores of people who all have a vested interest in the marriage.

Police and women's groups have called for a review of the custom of polygamy in Papua New Guinea, but few believe that the custom will be dropped. Polygamy has traditionally been the right of the country's "Big Men" or tribal leaders, but now non-traditional leaders such as politicians and businessmen are demanding the same rights. If women complain they are beaten, says Elizabeth Cox, Pacific co-ordinator for the International Women's Development Agency, who is based in Papua New Guinea's East Sepik province.

Cox says the intrusion of satellite television into the country's remote mountainous villages has made people question their traditional lifestyles. In a society where kissing in public is still taboo and where boys and girls have separate living quarters in villages, American soap operas such as *Beverly Hills 90210* promote Western morals where sex is central to a relationship and sexuality publicly displayed.

"Kissing is not seen in PNG and yet there is this preoccupation with sex on TV, which suggests this is the norm and a cool way to behave," says Cox. "There are video shops and satellite dishes everywhere. The old ways are being discarded but the imported values don't fit."

The end result of the clash of cultures is confusion and rising domestic violence. The School of Medicine at Port Moresby Hospital found urban, educated women suffered the most severe injuries. Cox says these women are the first in Papua New Guinea to achieve a degree of economic independence and reject the traditional subservient role of women. "Women are regarded as inferior and I think a lot of men's frustrations are being expressed by hitting out at the most vulnerable," says Cox. "Socially, young men are having a really hard time."

The Fiji Women's Crisis Centre in Suva is a little mauve timber cottage, a welcome refuge for frightened women. The iron security door at the front is permanently locked to stop violent husbands coming in. "Domestic violence is taken as a norm. It's endemic. One in four women live in regular violence," says Shamina Ali, co-ordinator of the centre. The centre takes in at least 40 women a month. In 1993, it accepted 660 women and children. It is illegal for a man to beat his wife in Fiji but most cases go unreported. Women may dread further beatings, but the fear of being without a male breadwinner in a country where only 30 per cent of women have paid jobs, as well as the shame of being ostracised by one's family, are far stronger influences.

While indigenous Fijian women come from a traditional, patriarchal society they are more likely to report domestic violence than Fiji's Indian women. In Fiji's Indian community, which makes up about half of the 750,000 population, arranged marriages are the norm and divorce virtually unheard of. "Violence in the Indian community is widespread, but a woman will never come forward," says Jalal, a Fijian-Indian.

Still, however, if a woman seeks the protection of police and the judicial system, she is seldom safe. When a beating is reported, often the policeman is related to the offender and reluctant to help the woman lay charges. Some police intimidate women to return to their husbands, and even if a woman manages to get her case to court, there is great pressure by the courts for reconciliation, say female social workers.

If the magistrate can get the woman to take her husband back, the case is dropped. Even when a wife-beater is found guilty, his sentence is usually lenient, a suspended sentence of one to 18 months. "The law does not protect women," says Ali. "Quite a few of our leaders are wife-bashers. I think we have to start exposing people. But we have a code of confidentiality."

## ainous villages has made people question their traditional lifestyles.

Rape victims in Fiji do not fare much better. Rape is illegal, but its definition is very narrow. In Fiji, a rape is only the act of sexual penetration and not other forms of sexual assault. Rape within marriage is not a crime. For a rapist to be convicted, a woman must satisfy the law of corroboration – she must produce a witness to the rape, and her past sexual experience can be used as evidence. But an accused rapist's past convictions for sexual offences are inadmissible.

Finally, the custom of “Bulubulu”, or forgiveness, sees many rape cases against indigenous Fijian women thrown out of court. Courts encourage rapists to ask forgiveness from a victim's family by offering a “Tabua” or whale's tooth, say women social workers. If the family accepts, the rape, as far as the legal system is concerned, is forgotten.

“Bulubulu traditionally was only for very minor infractions, trespass and common assault,” says Jalal. “But the courts now accept Bulubulu for rape and domestic violence – the two situations where women are the victims. The law does not exist in a vacuum, it exists to reflect a particular social and cultural ideology.”

South Pacific islanders are extremely religious thanks to the zeal of turn-of-the-century missionaries. But religion has become another discriminatory layer of Pacific society, says King. Most churches are male-dominated and although women play a large role, they have no voice – except in a choir.

In Fiji, sex and race are intertwined. To fight for women's rights is to fight against racial discrimination, says Jalal.

Women have suffered even more since the two 1987 military coups lead by then-army colonel Rabuka, who toppled Fiji's first government to be dominated by ethnic Indians. He has since introduced a racially-biased constitution, which guarantees indigenous Fijians a parliamentary majority. Women social workers say that in post-coup Fiji the influence of an authoritarian, militarist culture and the aggressive ethno-nationalism which it is fostering has led to an increase in crimes of physical violence against women.

Fiji's new constitution not only gives legal force to customs, such as Bulubulu, that discriminate against indigenous women, but it also politically and economically disenfranchises Indian women. The constitution prohibits Indians from owning land, which prevents Indian women becoming economically independent. Most squatters in Fiji are Indian.

“Pacific feminism is unique. We don't just address issues of gender,” says Jalal. “It is not possible for me to struggle on behalf of women without engaging in a question of race.”

Economic reforms by the Rabuka government in recent years, such as the creation of tax-free manufacturing zones, have resulted in more women gaining employment, but often in sweat-shop conditions. As Fijian women gain more rights they also encounter new forms of discrimination, which Western women fought a decade ago.

The question of equal pay for equal work is one of great concern to Fiji's trade union movement. Women garment workers earn about F\$30 to F\$40 a week, half what their male colleagues are paid. With more Fijian women entering the workforce, the incidence of sexual harassment at work has increased. More women are reporting male employers who ask for sexual favours in return for job security.

Things are even tougher in the Pacific's French territories of New Caledonia and French Polynesia, where indigenous women must struggle with de-colonialisation in order to achieve equal status. A softly-softly approach is being tried: there, the women say their main task is to “sensitise” men to the needs of women, not usurp men's power. “We're not trying to overtake the men. We want to complement them,” says Bernadette Pereira from the South Pacific Commission's Women's Resource Bureau in Noumea, New Caledonia.

Pacific women also need to be educated about their rights and how to achieve them, says the region's women social workers. “In the hierarchy, we walk and stand behind men at traditional gatherings, even the president's wife,” says King. “We need to educate the women chiefs to say, ‘Okay, women come and sit in your proper place’. We should educate women chiefs to make a stand for women.”

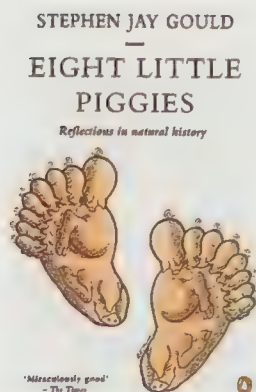
Younger Pacific men are also heeding the call and supporting women's rights. In Fiji, a group of young men have started a ‘Men Against Violence Campaign’. “It's sporadic. We have noticed the younger men coming back from studying overseas are asking us how can they support us,” says Ali.

Promoting feminism in the South Pacific requires a careful balancing act between subtle persuasion, direct action and court challenges. Feminist workshops are only held in villages after gaining permission from local chiefs, and women are never lectured to confront their husbands.

“The Pacific women's movement has grown at a very steady pace”, says Jayal. “There have been women's groups in the Pacific for the past 100 years. There are a lot of women's groups slowly taking on agenda. We think we will achieve our eventual goal by ‘talanoa’ – consensus. Consensus is the Pacific way.” ■

# Eight Little Piggies

Reflections in Natural History by Stephen Jay Gould



Reviewed by David Eyre

Paperback, Penguin 1993 (\$16.95)

*Eight Little Piggies* is volume six in Stephen Jay Gould's inimitable collection of essays on the subject of life, evolution and the history of the last 3.5 billion years or so. The title, a typically Gouldian play on words and ideas, is taken from his essay about the pentadactyl, or 'five-fingered', limb.

Conventional wisdom among evolution buffs has been that when tetrapods first emerged from the sea, some 390 to 340 million years ago, they had five digits per limb. Most subsequent tetrapods, from humans to horses, began their evolutionary history with five.

But, Gould informs us gleefully, recent fossil finds prove that the first tetrapods had seven or eight digits, so five digits represents at best a secondary stabilisation not an original state. He asks why five digits became such a common form in tetrapods. After looking at the evidence for five being the most functional number and therefore an ideal that "had to be", he comes down in favour of historical contingency – "five was not meant to be, but just happens to be". Hence the title, a play on the nursery rhyme, 'five little piggies went to market'.

Humans might just as easily have four fingers per hand but "think of arithmetic with base eight, the difficulty of playing triple fugues on the piano..."

Primarily an evolutionary biologist and palaeontologist, Gould has been professor of both zoology and geology at Harvard University. He is best known, however, for his popular science writing.

What chiefly distinguishes Gould's work from conventional academic articles is not lack of scholarly rigour but that he festoons his arguments with glittering asides and makes dazzling tangential leaps. He describes his approach in these 31 essays as "the conversion of detail to wide message, through links of tangential connection". Usually he opens with intriguing statements that appear to have little to do with the advertised topic but which turn out to be pertinent.

For example, Essay 6, "An Earful of Jaw" begins: "The most sublime of all beauties often proceed from the softest or the smallest – the quadruple pianissimos of Schubert's *Schöne Müllerin*... or the tiny birds of brilliant plumage depicted in the marginalia of medieval manuscripts. But even the most refined and intellectual character may succumb without shame to sheer din." He goes on to describe his experience singing bass in Berlioz's *Requiem* and how the thunder of the timpani rising through the wooden floor had caused him to "devolve into tears and spinal shivers": "In an odd and purely analogical sense, I had become a fish for a moment". All this is a preamble to a scholarly discourse about the evolution of the mammalian ear, via reptiles, from the fish ear.


Like the medieval scribes mentioned above, Gould is a master of marginalia, but his style owes more to the Victorian era. He has attained the elegance and chatty urbanity of 19th century English scholarship – Darwin, he tells us,

is his "intellectual role model", and it shows. The down side, however, is that he often takes forever to get to the point. This is definitely a book to be read at leisure.

In another fine Oxbridge tradition, Gould – very much a New Yorker – never insults us by being obvious. His dislike of bald statements may have contributed to the ease with which in recent years his work has been appropriated by opponents of the environment movement. Like Darwin, Gould has become a political football.

Gould has said, and reiterates here, that in the broad scale of things, human impacts on nature are trivial and it is therefore foolish and self-aggrandising to advocate an environment ethic in which humans are stewards of the planet. His position has been mistaken by both opponents and supporters of the environment movement to infer that it is natural and therefore perfectly OK if humans extinguish certain species and damage the environment.

In three essays collected under the heading "The Scale of Extinction", Gould gently reprimands his critics and unwanted supporters: "Capacity for recovery at geological time scales has no bearing whatever upon the meaning of extinction today... I love geological time – a wondrous and expansive notion that sets the foundation for my profession – but such vastness is not the proper scale for my personal life."

Gould manages to demystify his profession while, paradoxically, enhancing its decidedly romantic aura. He includes his readers in a world which, real or not, he is clearly in love with; a charmed realm of exotic field locations, book-lined studies, and museum rooms crammed with fossils. A world where people still read Latin and Greek, and in their spare time go to the opera, collect rare books and write poetry. Like all classical educations *Eight Little Piggies* provides the reader with brilliant insights into natural history alongside enlightened observations on the human condition. 

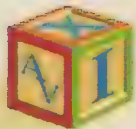
# The Society of Mind

by Marvin Minsky

REASONING

18.8 MATHEMATICS MADE HARD

definitions will always help children "get things straight." It can also make it easier for them to get things scrambled up. Instead, we ought to help them build more robust networks in their heads.



536

Reviewed by Paul Wallich

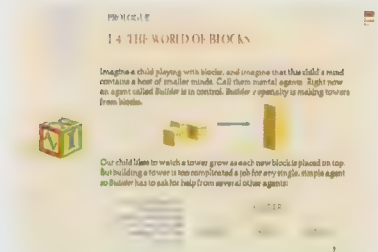
CD Rom, Voyager, 1994

The original text of Marvin Minsky's *The Society of Mind* is almost perfectly suited for an electronic book. One of the founders of the field of artificial intelligence, Minsky now believes that intelligence and consciousness are the result of myriad bite-size agents, each nearly mindless in isolation, interacting within the human brain. He wrote a book that reflects that structure – it consists of 262 short, easily absorbed chapters that build on one another's concepts in ever-more-complex fashion.

Minsky, head of the Media Lab at the Massachusetts Institute of Technology, is one

of many researchers in a wide range of fields who have seized on "emergent properties" – the notion that collections of simple objects can display remarkably complex behaviour if only you hook enough of them together. Variations on the emergence paradigm inform work on artificial neural networks, machine vision, controlled chaos and even new types of mathematical proof.

What better medium to convey this idea than one where readers can jump back and forth from section to section, learning what an "agent" is, seeing examples of how they fit



together, following the evolution of Minsky's arguments in whatever pattern fits their understanding: a modular book and the tools to assemble it. Voyager's CD-ROM comes with the original text, a raft of ancillary articles, animated illustrations and video sequences, and provisions for annotating in chunks of up to six pages at a time.

Of course there are many who disagree with Minsky's thesis: no matter how many k-lines (chains of tiny agents that work together to recreate previous mental states) you put together, they say, you will never get a mind. These same folk will probably be unimpressed by the video tour of Minsky's living room, during which the reader (viewer?) can select certain objects and watch a short film clip of Minsky explaining their particular significance to him. "How is this relevant? And besides, the pictures take too long to draw on the screen."

Surprisingly enough, dozens of short video segments of a bald, late-middle-aged professor with black-rimmed glasses kicking back and talking about his favourite subjects – from his inability to play the harp to other theories of mind – lend the electronic version of the book a certain familiarity that the print version lacks. It's rather as if the A.I. demigod had taken a couple of drinks, settled down in the next chair and started reading over your shoulder, waiting for only the slightest of signs of interest to start expanding on his text.

It will take much longer to finish the Expanded Book version of *The Society of Mind* than to read the print ("Shrunken Book"?) version. But that's all right. There are cross-references to follow, more film clips to watch, and a few hundred pages worth of skeptical notes to make in the margin. ■

# HP=MC<sup>2</sup>

The key to success in the IT industry is execution. And execution requires energy and a commitment to getting high-quality products onto the market at the right time, right price and with the right features.

It sounds too easy, really. In fact, Hewlett-Packard has reduced the strategy to a simple formula. It's HP=MC<sup>2</sup>. Believe us, a formula like this could explode a few myths and change the world.

The MC<sup>2</sup> stands for Measurement, Computers and Communications. These, we believe, are HP's strengths now and into the 21st century.

In a business environment where most rivals share similar technologies, nobody gets light years ahead of the competition. Success is hard-won and long remembered. Hewlett-Packard made the first desktop scientific calculator. That was eons ago – in 1968. The company was a pioneer in the days when PC might have stood for 'pocket calculator'. HP made the first pocket calculator in 1972.

Today, HP ranks first in minicomputers and laser printers, second in workstations, and first in a range of scientific measurement and medical instruments. Personal computers are the company's fastest-growing activity. In 1993, sales of HP products rose by almost a quarter to \$US20.3 billion. That's a lot of success and a lot of execution.

In the future, the company will be applying its MC<sup>2</sup> strategy to a new objective: merging its skills and experience into technologies to serve a multimedia age.

This is already happening. Earlier this year, Hewlett-Packard won a contract to supply computers for an interactive television system in the United States. The computers will store the movies and catalogues ordered by the system's subscribers.

Doctors in California are currently testing HP's prototype of a 'physician's workstation' – an

MC<sup>2</sup> device if there ever was. The workstation collects medical data from a network of hospital computers that variously contain information such as patient histories and pathology results, and assembles them for assessment on one computer screen.

The company is also working on software systems to make computers easy to use and program.

Further afield, HP hopes to produce a hand-held computer that also operates as a mobile phone, fax machine and electronic mail box. The machine will provide a wireless link to a computerised database or the printer at your office.

Few other companies have the established skills and experience to produce such multimedia devices. As the worlds of measurement, computers and communications come together, Hewlett-Packard hopes to make a unique contribution to IT that the others will find hard to beat.



A Better Way.



From studios in New York to galleries in Singapore, from the Australian Outback to Tokyo ArtLab: World Art is a truly global magazine of contemporary visual arts. For subscription information contact: Toll free: (0081224 018, Telephone: (02) 417 1723, Fax: (02) 417 1045.

ILLUSTRATION BY TRACY VINCENT



# stupider and stupider

Writer, performance artist, painter and one-time heroin addict William S. Burroughs looks into the future, and what he sees is not pleasant. The author of 'The Naked Lunch', and most recently a painter whose work has been acclaimed in exhibitions around the world, gives Nicholas Zurbrugg a piece of his mind.

William S. Burroughs, now 80, is a survivor of postmodern culture. From the hardboiled semi-surrealistic prose of *Junkie* (1953) and the hallucinatory fantasies of *Naked Lunch* (1959), from the filmic cut-ups of *Towers Open Fire* (1963) to the countercultural polemic of *Electronic Revolution* (1971), he has gone on to find fame as a performance artist, touring U.S. punk rock clubs with American performance artists Laurie Anderson and John Giorno. Since 1987, Burroughs has also won acclaim as a painter, with shows from New York to Basel, last year appearing in the Venice Biennale.

Yet surprisingly for a former hallucinogenic wanderer, open to both the idyllic and nightmarish alternative realities of drugs, dreams, space aliens and shamanistic rituals, Burroughs is, surprisingly, a man most rattled by the future of humanity.

**Burroughs:** The destruction of the rainforests is one of my principle

concerns. And overpopulation – it also comes down to overpopulation. They should put contraceptives in the water supply! Not only do you have a proliferation, but it's a proliferation of a third-rate product. It seems we're getting an increasingly flawed human product. It's incredible. In a recent poll, something like half the number of U.S. high-school graduates could not locate Vietnam on the map, and didn't know we'd fought a war there, much less that we'd lost a war there. And when it comes to World War II, no idea who Churchill was, or Stalin – didn't know about Stalin! These are high school graduates! It's appalling! Then there was a sex poll, and half of those polled thought that homosexual intercourse could cause AIDS, even if neither party was infected with the virus. Good heavens, what is this – the immaculate conception? It's appalling. People are getting stupider and stupider! There's no doubt about it.

*Is this enough to drive you back to teaching, to try to remedy it?*

No. No, no, no. It's past remedy. It's hopeless. There's nothing you can do with something like that.

*You've contributed some thoughts on drug hysteria to the new collection, High Risk.*

Well, I said what I had to say about the whole preposterous war against drugs. It's a very calculated move to increase police power – that is, to use this hysteria in order to increase police power, and concentrate power in the bureaucracy, in Washington, D.C. Ever since the [U.S.] Civil War, there's been a tendency on the part of Washington to try to abrogate states' rights and to concentrate power in Washington. And this is another move in that direction.

*Are there any other things that you would still like to explore?*

I'm very interested in all of these space aliens – their flying saucers, and all that. I went to see Whitley Strieber, who's the author of a book called *Communion* which they made into a film about experiences with "The Visitors", as he calls them. I visited him for a weekend in upstate New York, but I didn't see anything – they're really sporadic. All the people living around him all say, yes, they have seen these things, but they don't want to talk about it. He puts out a *Communion* newsletter with thousands and thousands of accounts. So I'm convinced that it's a real phenomenon. I'd just like to see some myself, that's all. As a matter of fact, there have been sightings in Kansas, and some out at the lake where I have my house. But I've not been favoured.

*Do you think that technological advances offer much hope for the future?*

Well, we have all this technology and ways of disseminating information, but we have this appalling ignorance. Eight per cent of the population couldn't even find America on the map, in the United States! And I read recently that the same thing is true in Brazil. So you have all this technology, but what's it doing? Are people becoming more aware? Are they availing themselves of all this information? Apparently, not at all.

*So maybe the challenge is to work out what the potential is?*

I don't think there is any. It's sort of strange, but we're just getting stupider and stupider. One thing that characterises the present day are these separations between, say, people who have any awareness, and the mainstream that is just sinking into a state bordering on the far side of idiocy. There are going to be more and more stratifications, separations, and gaps between people, and there's no cultural cohesion at all.

*Is this perhaps why you're interested in things like shamanism, because it's a return to something fundamental and substantial?*

Well, it's not necessarily a return, but a going on to some sort of basic change, biological change, mutations. It seems to me speaking of the mainstream that it's going nowhere. It's going nowhere rather fast. It's appalling. Of course, no politicians can address the issues – such as the destruction of the rainforests – or take the measures that would be necessary, in time. They will not do anything until it's too late. The only thing that gets homo sap up off his dead ass is a foot up it! And that foot usually comes too late. They won't do anything about it until it's much too late. Till they've destroyed the ozone layer. They're destroying the rainforests – the lungs of the world – then when something drastic happens, we'll suddenly say, "My God, I can't breathe!" And then it will be way too late.

*Do you have other predictions for the next few decades?*

All bad, all bad. More and more overpopulation and pollution. So it just looks bad all around. There are people doing what they can, doing admirable work – environmental organisations and institutions and animal conservation organisations – but they're pretty much a very small number. I'm doing paintings on the seven deadly sins, and also writing on each one, showing the ravages of, well, Avarice, for example. That's at the back of all this destruction of the environment. Corporations don't care what happens to the rain forests or anything, so long as they can make a good show in front of their stockholders. And so on, and so on, right down the line. Sloth, that's the whole bureaucracy. "Take the easy way! Go by the book! Don't stick your neck out!" And then, Anger, of course – pride and anger. The war against drugs is an example of stupid, undisciplined anger – hysteria manipulated by interested parties. And it's a pretty bleak picture. 25-C



Françoise Janicot

**Humans will not do anything until it's too late. The only thing that gets homo sap up off his dead ass is a foot up it!**

**NATURAL SPRING WATER**



**SPLITROCK**

Vic: (03) 867 7961    NSW: (02) 365 4218    Qld: (075) 970 699

DON'T  
CRACK  
UNDER  
PRESSURE



The 6000 Chronometer series.  
Officially certified automatic  
chronometer movement. 18 karat  
gold and finely brushed steel.  
Distinctive leather strap with  
saddle stitching and folding buckle.  
Scratch-resistant sapphire crystal  
with magnified date indicator.  
Water-resistant to 200 meters.



**TAGHeuer**  
SWISS MADE SINCE 1860

For your nearest  
Tag Heuer stockist  
Telephone - 1 800 809 915